1000 PRACTICAL AIR BRAKE QUESTIONS AND ANSWERS FOR RAILROADMEN

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PREFACE.

The Railroad Companies throughout the country to-day are putting forth every effort to equip their rolling stock with the best brakes possible, and while the brakes are constantly being improved upon, it is growing to a massive subject. The Locomotive Engineer of this age must be qualified to handle long, heavy trains and manipulate the brake with safety to company property, employes' lives and the lives of millions of people, who depend on the Engineer to take them safely to their desitnation.

Facing such facts, I realize it is necessary in behalf of the railroad men, that the braking system be sifted down to practical plain talk, which is within the reach of every railroad man to more easily comprehend its meaning. H. M. S.

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INTRODUCTORY.

Engineers, Firemen and Trainmen are required to pass a creditable examination on air brakes. To pass, Engineers and Firemen must receive a rating of 85 per cent; Trainmen, 60 per cent. This book contains an explanation of each essential part of the brake system. It also contains each question asked in an instruction room examination, and for a special examination, reduced to plain facts and common language, intended expressly to benefit railroad men, railroad companies, and for the safety of the public in general.

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1,000 PRACTICAL QUESTIONS AND ANSWERS ON THE WESTINGHOUSE AIR-BRAKE.

REDUCED TO PLAIN TALK.

Q. What is a brake? A. A device for stopping revolving wheels.

Q What is a Power brake? A. A brake operated by manufactured power.

Q. What is an air brake? A. One that is operated by compressed air.

Q Where do we get the air? A. From the atmosphere, and is compressed.

How is it compressed? A. By an air compressor, operated by a small engine, propelled by steam pressure, commonly called an air pump.

Q. What style of air pumps are most used? A. The 9½-inch, and a small per cent. of 8-inch pumps.

AIR PUMPS.

8-Inch Pumps.

Q. Why is it called an 8-inch pump? A. Because the steam piston is 8 inches in diameter.

What is the diameter of the air piston? A. Seven and one-half inches.

Q. What stroke has the 8-inch pump? A. Nine-inch stroke.

Q. How many operative parts has the steam end of the 8-inch pump? A. Five.

Q. Name them? A. The main steam piston, reversing piston, reversing valve, reversing valve rod and reversing plate.

in an 8-inch pump? A. All on the one side of the air

Q. How many valves are there in the air end of an 8-inch pump? A. 4.

Q. Name them. A. Two receiving and two discharge valves.

Q. How many air inlets has an 8-inch pump? A. Two.

Q. Is the 8-inch a single or double acting pump? A. Double acting.

Q. What do we mean when we say a double acting pump? A. A pump that compresses air on both up and down stroke.

Q. How are the receiving and discharge valves located cylinder though in two separate cages, one above the other.

Q. Which is the receiving valve in each cage? A. The lower valve.

Q. Are the receiving and discharge valves in an 8-inch pump of the same size? A. No; the receiving valves are the smaller.

Q. Do the valves all have the same lift? A. No; the receiving valves being smaller have ⅛ of an inch lift, and the discharge valves have a 3-32 of an inch lift.

Q. Occasionally an 8-inch pump will stop and you cannot get it to make a stroke. What might be the cause? A. The stop pin may be worn too short and allows the piston to drop low enough to allow the packing ring to expand below the bush.

Q. What stops the discharge valve in its lift? A. The top pin in the cage.

Q. What stops the receiving valve in its lift? A. The discharge valve.

AIR PUMPS.

9½-Inch Pumps.

Q. Which is the standard pump on the Pennsylvania system? A. The 9½-inch.

Q. Is there any difference between the 8-inch and the 9½-inch pump? A. The 9½-inch pump is a larger pump with a much greater pumping capacity and the operation of the valve gearing is more easily understood.

Q. How many kinds of 9½-inch pumps are there? A. Two.

Q. Name them. A. A right-hand, and a right and left-hand pump.

Q. Where is the difference in these pumps? A. A right-hand pump has one steam pipe connection and one exhaust. The right and left-hand pump has a steam and exhaust connection on each side.

Q How can you tell which is the steam and which is the exhaust connection? A. The lower one—the smaller one on either side—is the steam connection. The top and larger one is the exhaust.

Q What are the operative parts of the steam end of a 9½-inch pump? A. Steam piston, differential piston, steam valve, reversing valve, reversing valve rod and reversing plate.

Q What is the duty of the steam piston? A. To operate and move the air piston.

Q. The duty of the steam valve? A. To admit and exhaust steam to and from either end of the steam cylinder.

Q. Duty of differential piston? A. To move the steam valve.

Q. Duty of the reversing slide valve? A. To admit steam to, and exhaust steam from, the right side of the differential piston 77.

Q. Duty of the reversing valve rod? A. To move the reversing slide valve.

Q. Duty of the reversing plate? A. To raise and lower the reversing rod.

Q. Name the operative parts of the air cylinder. A. Air piston, two receiving and two discharge valves.

Q. Where are the valves located? A. The receiving valves are located on the left side of the pump; the same side the air inlet is on. Discharge valves on the right side—same side as the exhaust.

Q. Are the air valves all the same size? A. Yes.

Q. What lift have the air valves? A. 3-32 of an inch.

Q. What is the diameter of the steam and air cylinders of a 9½-inch pump? A. 9½ inches.

Q. What is the stroke of the piston? A. 10 inches.

Q. A small port leading through the cylinder cap from the left of the differential piston is for what purpose? A. To prevent steam pressure from accumulating back of piston 79.

Q. If this port should become closed, would the pumps stop and on which stroke? A. It would stop on the up-stroke.

Q. A small port leading through the cap nut of the reversing slide valve chamber, should this port become closed, would the pump stop? A. The pump might stop. If it did it would be just before it reached the completion of the up-stroke.

Q. On starting a pump which is the first stroke the piston makes? A. The up-stroke.

Q. How is the proper way to start a pump? A. See that the drain cocks are open; feed 10 to 15 drops of oil through the lubricator. Turn on steam to start the pump to run at about 40 strokes per minute. As soon as the steam cylinder is drained close the drain cocks and lubricate the air cylinder.

Q. How would you lubricate the air cylinder? A. By oiling through the oil cup.

Q. How many cupsful would you give a pump at one oiling? A. Some pumps require more oil than others, but usually three cupsful is sufficient.

Q. What kind of oil should be used? A. The best of valve oil.

Q Is it a good practice to oil the air cylinder through the air inlet? A. Never oil through the inlet. It will close the inlet strainer and air-ways.

Q Where are the drain cocks located? A. One is connected to Passage B in the wall of the steam cylinder, the other to the exhaust.

Q. What are the drain cocks for? A. To drain any moisture that may be in the pump.

Q. How should the drain cocks be when the pump is not working? A. Open at all times.

Q. How long should the pump run at 40 strokes per minute? A. Until the main reservoir pressure raises to 25 or 30 lbs.

Q. Why would you want 25 or 30 lbs. of main reservoir pressure before speeding up to normal speed? A. This pressure will cushion the pump and prevent the piston from pounding against the pump heads. There is no provision made in the steam end of a pump for a cushion, hence the cushion must be formed in the air end.

Q. What is the limited speed of a pump? A. 70 double or 140 single strokes per minute.

Q. Why would higher speed be injurious to a pump? A. The air valves have so small a lift. To race a pump very little air will pass into the pump on each stroke. This will cause the pump to heat.

Q. How can you tell if a receiving or a discharge valve is broken? A. By the iregular stroke of the pump.

Q. How could you tell if the top receiving valve was broken or stuck open? A. On the down-stroke of the piston air would be taken in. When the motion was reversed and the piston starts on its up-stroke there would be a puff of air out at inlet. This puff would cease as soon as a vacuum was caused under the air piston. The lower receiving valve would be unseated and the air would pass from the top end of the cylinder into the lower end by way of broken receiving valve and down through the air-way, past the lower receiving valve into the lower end of the cylinder.

NOTE—The pump would have a quick up-stroke, always toward a broken receiving valve.

Q. How could you tell if the lower receiving valve was broken or stuck open? A. The pump would operate the same as with the top receiving valve broken, only in the

opposite movement.

Q. Now if the top receiving valve was stuck shut, how would the pump operate? A. No air would be taken into the pump on the down-stroke.

Q. How would the pump travel? A. The down-stroke would be slow on account of the piston pulling against a vacuum above the piston. The up-stroke would be quick on account of the vacuum assisting the steam under the steam piston.

Q. If the lower receiving valve was stuck shut, how would the pump operate? A. The same as with the top receiving valve stuck shut, only in the opposite stroke.

Q. With a receiving valve broke the quick stroke of the piston would be— A. Always toward the broken valve.

Q. A broken discharge valve, the quick stroke is— A. Always from the broken discharge valve.

Q. Why is the quick stroke towards a broken receiving valve? A. There is no compression there, and the steam drives the piston quickly.

Q. Why is the quick stroke from a broken discharge valve? A. There is a compression there, but the main reservoir pressure assists the steam and the piston is driven quickly from the broken valve.

Q. If the top discharge valve was broken or stuck open, how would the pump operate? A. The piston would have a quick down-stroke and a slow up-stroke. There would be no air taken in on the down-stroke.

Q. How could you test to tell if the top or bottom discharge valve was broken or stuck shut? A. Pump up the pressure. Stop the pump, open oil cup. If the top discharge valve was broken there would be a constant flow of air through the oil cup.

Q. If the lower discharge valve is broken, how could you tell? A. Remove the stop plug in the lower pump head. If the lower discharge valve is broken a constant flow of air will be indicated.

Q Is this always a good test? A. If the piston packing rings are good it is a good test. If the packing is very bad either top or bottom pressure might leak past.

Q. If the lower discharge valve was broken, how would the pump work? A. The same as described for top discharge valve, but in the opposite stroke of the pump.

Q. With a defective air valve, are we gaining any pressure? A. With tight air piston packing rings, we are gaining air from one end of the air cylinder.

Q. How can we tell if the air piston packing rings are bad? A. Run the pump at about 50 strokes per minute, place your hand on the air inlet and note if air is taken in the full length of the stroke. If so, O K, but if air is taken in only on about the first half of the stroke the packing rings are leaking; such packing rings should be renewed.

Q. Is a 9½-inch pump a single or double-acting pump? A. A double-acting.

Q. How can we tell whether it is a receiving or discharge valve that is broken, and if it is a top or bottom valve? A. Place your hand on the air inlet and watch the motion of the pump. If on the up-stroke of the piston there is no air taken in at the inlet the lower discharge valve is broken. This would be a quick stroke. If there is a quick down-stroke and no air taken in at the inlet the top discharge valve is broken. If on the down-stroke a full draft of air is taken in, and on the reversing of the stroke you receive a puff of air out through the inlet, the top receiving valve is broken. The up-stroke will be the quick stroke. If the lower receiving valve is broken there will be a puff of air at the inlet with a quick down-stroke.

Q. What will cause a pump to stop? A. Badly worn or loose reversing plate, reversing plate bolts working loose, bent or broken reversing rod, nuts working loose on air piston, nuts working loose on either end of differential piston, a cracked copper gasket under top head; leaking be-

tween Passage B and cylinder will cause pump to stall when working against high pressure. Pumps often stop for the want of lubrication.

Q. When a pump stops, how should we proceed to get it started again? A. Shut off the steam from the boiler; open drain cock 106 attached to steam passage. This will releive the pump of its pressure. Then turn on the steam suddenly. The pumps will often run or, at least, make a few strokes, which will enable one to locate the trouble. If the pump will not lubricate shut off the steam, remove the cap nut from the reversing valve chamber and drop a small quantity of valve oil in around the slide valve. Never pound a 9½-inch pump to make it start.

Q. What will cause a pump to stop on the up-stroke? A. Reversing plate bolts coming part way out, nut dropping off of diffedential piston, left side.

Q. What will cause a pump to stop on the down-stroke? A. A nut drops off of differential piston, right side; nut works loose on air piston, piece of a broken check valve getting under piston, loose or worn reversing plate or a broken reversing rod.

Q. How can we tell on which stroke the pump has stopped? A. Open the drain cock to the steam-way (the one on the left side of pump); if the pump has stopped on the down-stroke there will be no steam or, possibly, a very little escape. If the pump has stopped on the up-stroke there will be a constant strong flow of steam out through the drain cock.

Q. How should the piston be oiled between the packing nuts? A. By using a swab saturated with valve oil.

Q. What causes pumps to stop on one-half stroke? A. Bent or broken reversing valve rod.

Q. At what point in the air cylinder does the greatest wear take place? A. Near the end of the stroke.

Q. Why? A. On account of the highest pressure at that point.

Q. What causes a pump to pound? A. Water in the steam cylinder, pump getting too much oil, pump loose on bracket, bracket loose on boiler, air valves having too much lift, or jamb nut working loose under air piston.

Q. We say a pump will stop on the down-stroke. If the piston nuts work loose, how can we tell that the piston nuts are loose and that the pump has stopped on the down-stroke? A. Shut off the steam; the air piston has not completed its stroke; the reversing valve is up, the differential piston and steam valve are to the left. By opening the drain cock there will be no steam escape, because on the down-stroke steam Passage B registers with the exhaust through the cavity of the steam valve, and by no steam escaping through the drain cock will tell you that the piston has stopped before it completed its down-stroke. By shutting off the steam the pump is relieved of its pressure, thus allowing the reversing valve to drop down by its own weight. In a short time by admitting steam into the pump the pump will make an up-and-down stroke and stop again. You will hear the piston nut strike the lower pump head.

Q. If the piston nut was found to be off, how can we hold the piston from turning round while we tighten the nut on again? A. Shut off the steam, remove the right-hand head from the differential cylinder, block the differential piston to the left, replace the head, turn on the steam; the piston will make a down-stroke and stop, being held there by the steam above the steam piston. Never apply an alligator or Stilsen wrench to the piston between packing nuts. Sometimes by tightening the packing nuts piston may be held. Some pistons have a hole tapped in the under part of the head. A bolt may be inserted, thus preventing the piston from turning.

Q. Is there any other cause for the pump stopping and the trouble would not be in the pump? A. Yes; the pump governor may not be working properly. The pump may

not be getting steam, or it may not be exhausting.

Q. How can you tell if the pump is getting steam? A. Slack the nut at the steam connection at the pump. If steam escapes freely the pump is getting steam, then slack the nut on the exhaust pipe to see if the steam is exhausting.

Q. If the exhaust pipe was closed in the front end, how would a pump perform? A. On starting the pump it would make a few strokes and stop.

Q. How could you tell quickly if the steam was shut off at the governor? A. Cut the governor out of service.

Q. If the air inlet becomes stopped up with dirt and you could not get the inlet off, what would you do? A. Punch holes in the strainer to let air in. Pump must get air somehow.

Q. If the air-ways become stopped up while on the road, what could you do? A. Nothing.

Q. What causes a pump to heat? A. Racing, want of oil, stuck or leaky air valves, obstructed air inlet or air passages to or from the air cylinder, working against a high main reservoir pressure, bad packing rings on air piston—the most frequent cause.

Q. The pump appears to be working at good speed, but you are not gaining main reservoir pressure. What would you look for. A. A piece of paper or a leaf may be covering the inlet.

Q. How could you cool an excessive hot pump? A. Throttle down to low speed and oil with best of lubricating oil.

Q. Explain the operation of a 9½-inch air pump in both the up and down-strokes. A. When steam enters the pump it fills the space between the differential pistons, also passes through a passage leading to the reversing slide valve chamber. This chamber is constantly filled with live steam. When the steam enters the pump, if the differential piston is not to the extreme right, the steam will quickly force it there. In this position of the differential piston the

steam valve has been brought to uncover port "B," which leads down through the walls of the steam cylinder to the lower end, and steam flows through port "B" and is admitted into the lower end of the cylinder under the piston. This forces the piston upward. The piston continues on its up-stroke until within ¾ inches of the end of the stroke. The reversing plate on top of the piston engages the shoulder on the reversing valve rod and raises it; this raises the reversing slide valve, which brings a port in its bush to register the reversing slide valve chamber with the face of the large differential piston No. 77, then the steam will quickly equalize on both sides of piston No. 77 when steam has power against piston No. 79 and will move it to the left. The up-stroke being completed and the port leading to the top of the cylinder is opened by the steam valve moving to the left. In this position of the steam valve also register port "B" with the exhaust, and while the steam that drove the piston up is passing from under the piston through port "B" cavity of steam valve and exhaust live steam is flowing down on top of the piston, driving it down until within ¾ inches of the down-stroke, when the reversing plate engages the knob on the lower end of the reversing rod, pulling it down. This also pulls the reversing slide valve down, which closes communication between the slide valve chamber and piston No. 77 and brings to register the pressure against the face of piston No. 77 with the exhaust by way of groove in the face of the reversing slide valve. Thus the pump has made an up-and-down stroke.

MAIN RESERVOIR.

Q. After air is taken from the atmosphere and compressed, it is stored where? A. In the main reservoir.

Q. What is the main reservoir for? A. A storehouse for compressed air.

Q. Is it used for any other purpose? A. Yes; it acts as a catch-basin, catching the dirt and moisture that is

taken in with the air. It also acts as a cooler—cooling the air before it reaches the brake valve.

Q. Is the air cool where it enters the pump? A. Yes.

Q. In the compression does the air get heated? A. Yes; and passes to the main reservoir hot.

Q. We say main reservoir pressure extends from the discharge valves of the pumps to the rotary valve in the automatic brake valve? A. Yes.

Q. How far is it from the pump to the automatic brake valve? A. About 30 feet.

Q. How many main reservoirs are used on each engine? A. Some have two, others have four, main reservoirs.

Q. Where are they located? A. At the most convenient place.

Q. Why do some engines have four main reservoirs? A. To carry in store a large volume of air to insure a prompt release of the rear brakes on a long train.

Q. Who is responsible for draining the main reservoir? A. The engineer.

Q. How often should he drain the main reservoir? A. Once a week, and oftener in rainy weather.

Q. If the main reservoir becomes partly filled with water, will it affect the application of the brakes? A. No; the quick-action brake cylinders do not get their pressure from the main reservoir to apply the brakes.

Q. Will water in the main reservoir interfere with releasing the brakes? A. It will on a long train. The more water that is in the main reservoir the smaller the air volume, and with a long train you may not have a sufficient main reservoir volume to build up the train pipe pressure on the rear end of a long train to push the tripple pistons to release position. Hence the rear brakes will stay applied.

Q. How many main reservoirs do the different classes of engines have, and with what cubic inch capacity? A. H. 6a and H. 6b, 4 main reservoirs, 74,000 cubic inches; H. 8, 2

main reservoirs, 74,000 cubic inches; D. 16, B. 8, F. 1 and R, 2 main reservoirs, 39,200 cubic inches; B. 4, 1 main reservoir, 26,000 cubic inches; E. 2 and E. 3, 2 main reservoirs, 36,600 cubic inches; K. engine, 2 main reservoirs, 50,000 cubic inches.

Q. What design of main reservoir is most desirable? A. Long, slim reservoir.

Q. Why? A. It gives better radiation for cooling.

SINGLE-TOP PUMP GOVERNOR.

Q. Name the different parts of a pump governor. A. Cap nut, tension nut, adjusting spring, diaphragm, pin valve spring, governor piston, piston spring and steam valve.

Q. What is the normal position of the governor? A. Open.

Q. On what line of pipe is the governor located? A. On steam pipe leading from the boiler to the pump.

Q. What is the duty of the pump governor? A. To stop the pumps when the desired main reservoir pressure is obtained.

Q. Is the governor operated by steam or air? A. Operated by air.

Q. What air pressure operates it? A. Main reservoir pressure.

Q. What is the port in the spring case for? A. Should the diaphragm be leaking this port will prevent a pressure accumulating in the spring case above the diaphragm.

Q. If this port was closed and air leaked past the diaphragm, what would be the result? A. Equalization would occur above and below the diaphragm; the pin valve could not be unseated. The governor could not stop the pump and very high main reservoir pressure would be the result.

Q. What is the release port C attached to the chamber above the governor piston for? A. To allow the pressure above the piston to escape after the pin valve is seated, thus making the pump more sensitive in starting.

Q. If the release port was stopped up would the pump stop? A. Yes.

Q. Would the pump start? A. It depends on the condition of the piston packing rings as to how long it would take the pump to start. The pressure above the piston will leak down past the packing rings and escape at the drip pipe; otherwise the piston could not raise to unseat the steam valve.

Q. If the pin valve would not seat on account of dirt on its seat, or it might be slightly bent, would the pump work? A. That depends on how bad the pin valve is leaking. If the leak is slight and the air can escape through Port C as fast as it leaks past the pin valve the pump will work. But if the leak past the pin valve is greater than can escape through Port C the pump would travel sluggish and may stop.

Q. Why not make Port C larger? A. To do so would only be a waste of main reservoir air while the governor had the pump stopped.

Q. If there is a constant blow at Port C which would be a waste of air, would you plug the port to stop the leak? A. No.

Q. If this port was plugged or closed with dirt, what would be the result? A. The pump would stop; you could not get it to make a stroke.

Q. Why is the drip pipe connected to the governor under the piston? A. To allow any steam to escape that may leak past the steam valve stem.

Q. If the drip pipe was closed with dirt or was frozen shut, what would be the result? A. The governor could not stop the pump, and high main reservoir pressure would result.

Q. What causes a strong waste of steam from one drip pipe, while at another there will be very little, if any? A. This depends on the condition of the steam valve; it is the steam that leaks past the collar of the steam valve that escapes through the drip pipe.

Q. What is the normal position of the governor?

A. Open.

Q. If the casing around the piston becomes worn the piston will occasionally stick. How would you get it loose? A. Tap the governor or pipe; this will jar it loose.

Q. Explain the operation of the governor in normal and closed positions. A. In normal position the steam valve is open; the pin valve is seated, the adjusting spring is holding the diaphragm down; steam is passing to the pump and main reservoir air is under the diaphragm. As soon as the main reservoir pressure is raised to slightly greater than the tension of the adjusting spring the diaphragm is raised, which unseats the pin valve, and main reservoir air passes down over the pin valve seat on top of the governor piston, forcing it down, which forces the steam valve to its seat, shutting off the steam from the pump. It will stand this way only as long as the main reservoir pressure is strong enough to keep the diaphragm raised. Just as soon as the main reservoir pressure is weakened the adjusting spring will expand, force the the diaphragm down, seat the pin valve. The air that is above the governor piston will escape through Port C, which is open to the atmosphere at all times; the piston spring will lift the piston, which will unseat the steam valve, and the pump will start again.

Q. To adjust a governor for higher pressure remove the cap nut, screw the adjusting nut down; for a lighter pressure screw it up.

Q. Does the air pass through a strainer to enter the governor? A. Yes.

Q. If this strainer should close up, what would be the result? A. High main reservoir pressure.

AUTOMATIC BRAKE VALVE.

G-6 Brake Valve.

Q. How many valves are there in the G-6 brake valve? A. Two.

Q. Name them. A. Rotary and equalizing discharge valve.

Q. What is the rotary valve's duty? A. To register the various ports with the ports in its seat.

Q. What is the duty of the equalizing discharge valve? A. In making a service application of the brake it automatically controls the flow of air from the train pipe to the atmosphere.

Q. With the G-6 brake valve on lap position, what pressure does the rotary valve divide? A. Main reservoir pressure, train pipe and equalizing pressure.

Q. With the G-6 brake valve on lap, what pressure does the equalizing discharge valve separate? A. The train pipe and equalizing pressure.

A. All ports are closed, With brake valve handle in serv-

Q. What is the duty of the brake valve? A. It is a mechanical device by which the brakes may be applied and released.

Q. How many positions has the G-6 brake valve? A. Five.

Q. Name them. A. Release, running, lap, service and emergency.

Q. To start the pump with the brake valve handle in release position, how will the pointers on the gauge raise, and where will they stop? A. In release position the rotary valve opens direct communication between the main reservoir and train pipe, and both pointers will raise together and stop at 100 lbs., if the governor is set at 100 lbs.

Q. How will the gauge pointers raise with brake valve handle in running position? A. This being the indirect way, by way of the feed valve, the red pointer will raise about 8 lbs.; then the black pointer will start and follow about 8 lbs. behind the red pointer and stop at 70 lbs.; the red pointer will stop at 100 lbs.

Q. Why is this? A. It takes about 8 lbs. to operate the feed valve.

Q. How will the pointers raise with the brake valve on lap? A. The red pointer will raise and stop at 100 lbs.

The black pointer will stay at O.

Q. To start the pump with brake valve handle in service or emergency positions, how will the gauge pointers raise? A. The same as on lap position.

Q. Why is this? A. Because with the brake valve handle in either lap, service or emergency position you are gaining main reservoir pressure only.

Q. Of the five positions of the automatic brake valve, in how many positions is the rotary valve used alone? A. Three; release, lap and emergency.

Q. In the other two positions, what valves are used with the rotary valve? A. In running position, the feed valve. In service position the equalizing discharge valve is used.

Q. What pressure is always on top of the rotary valve? A. Main reservoir pressure.

Q. With the G-6 brake valve handle in release position, air is passing through from where to where? A. From the main reservoir to the train pipe; from the main reservoir to equalizing reservoir through Ports G and E, and to the atmosphere through the Warning Port R.

Q. In running position, air passes from where to where? A. From the main reservoir through the feed valve into the train pipe; from the train pipe to Chamber D, and the equalizing reservoir.

Q. On lap position, air passes from where to where? A. All ports are closed.

Q. With brake valve handle in service position, air passes from where to where? A. From Chamber D to the atmosphere through the preliminary exhaust port, and from the train pipe to the atmosphere past the equalizing discharge valve.

Q. With brake valve handle in emergency position, air passes from where to where? A. From the train pipe direct to the atmosphere by way of straight exhaust, and from the equalizing pressure to the atmosphere through Port E, and straight exhaust.

Q. Is the equalizing reservoir connected to Chamber D at all times? A. Yes.

Q. Why is this reservoir attached to Chamber D? A. To enlarge Chamber D volume, giving a larger volume to draw from when applying the brake in service. Chamber D volume of itself is too small to make a gradual reduction from.

Q. To what volume does the equalizing reservoir raise Chamber D volume to? A. The standard equalizing reservoir is 10x14½ inches and increases the volume of Chamber D pressure to 800 cubic inches.

Q. How many ways does the air pass from the main reservoir to the train pipe? A. Two.

Q. Name them. A. Direct, with the brake valve in release position; indirect, with the brake valve in running position by way of feed valve.

Q. If we apply the brake with a service reduction of 8 or 10 lbs., and soon we hear the brakes releasing, is the trouble in the brake valve? A. It may be that the rotary valve or gasket is leaking, or there may be an auxiliary leak. Either of these defects would release the brakes.

Q. How can we tell where the trouble is? A. Apply the brakes again and watch the train pipe gauge pointer. If it raises the rotary valve or gasket is leaking. If the pointer stands still it's an auxiliary leak.

Q. In all, how many brake valves are used on P. R. R. engines? A. Four in all.

Q. Name them. A. G-6 and H-6 automatic, S W A and S-6 straight air.

DUPLEX PUMP GOVERNOR.

automatic brake valve and S-6 straight air brake valve explained in E T-6 equipment.

STRAIGHT AIR BRAKE VALVE.

S. W A.

Q. What is the letter of this valve? A. S W A.

Q. How many valves are used in connection with the

straight air brake? A. Four.

Q. Name them. A. Reducing valve, brake valve, double-seated check valve and safety valve.

Q. How many valves are there in the brake valve? A. Two.

Q. What are they called? A. Application and exhaust valve.

Q. How are these valves operated? A. By a shaft to which the handle is attached.

Q. What kind of seats do the application and exhaust valve have? A. Leather seats.

Q. How many positions has the straight air brake valve? A. Three.

Q. Name these positions. A. Release, application and lap.

Q. In application position, if the exhaust valve is leaking, where will the blow occur? A. At the brake valve exhaust.

Q. When in release position, if the application valve is leaking, the blow will be where? A. At the brake valve also.

Q. For what service was the straight air brake designed? A. For shifting service.

Q. Why for shifting service? A. To get a brake that can be applied and released quickly.

Q. Where is the safety valve located? A. At the brake cylinder.

Q. What is the safety valve set at? A. 53 lbs.

Q. Where is the double-seated check valve located? A. At union of air pipes leading to the brake cylinder.

Q. What would cause a blow at the triple exhaust, when the straight air brake is applied? A. The double-seated check valve would be leaking at the automatic side.

Q. If a blow occurs at the exhaust of the straight air brake valve, when the brakes are applied automatically, where is the trouble? A. The double-seated check valve is leaking at the straight air side.

Q. What kind of seats has the double-seated check valve? A. Leather.

Q. Why? A. Being near the main reservoir they would naturally come in contact with oil, and rubber will not year in oil, so leather seats are used.

Q. Was the straight air brake intended to be used on other than shifting engines? A. Yes; it may be used to good advantage in either freight or passenger service.

Q. How could you cut out a straight air brake? A. The reducing valve has a cut-out cock. If closed will cut out the brake. If a C-6 reducing valve is used slack the tension on the adjusting spring to allow the regulating valve to seat; that will cut the brake out.

Q. Having the automatic brake applies and you desire to keep the slack bunched, when would you apply the straight air brake? A. Just before releasing the automatic brake.

Q. Can the straight air brake be applied after a partial application of the automatic brake? A. Yes.

Q. With the straight air brake fully applied, can the brake cylinder pressure be raised by applying the automatic brake? A. Yes; the brake cylinder pressure can be raised, but the safety valve will blow to the atmosphere all pressure above 53 lbs.

Q. After applying the straight air brake partially, what may prevent the straight air from releasing? A. An application of the automatic brake may reverse the double-seated check valve and the straight air cannot release.

Q. Where is the reducing valve located? A. On a line of pipe leading from the main reservoir to the brake valve.

Q. What is the reducing set at? A. 45 lbs.

PRESSURE.

Q. How many pressures are used with a complete quick-action brake? A. Six.

Name the pressures. A. Atmosphere, main reservoir, train pipe, auxiliary reservoir, brake cylinder and equalizing reservoir pressure.

Q. What pressure does each pressure contain per square inch? A. In passenger service, pressure per square inch:

Atmosphere	14 7-10	lbs.
Main reservoir	140	lbs.
Train pipe	110	lbs.
Auxiliary reservoir	110	lbs.
Equalizing reservoir	110	lbs.
Brake cylinder pressure equalized at about	58	lbs.

In freigh service:

Atmospheric pressure	14 7-10	lbs.
Main reservoir	100	lbs.
Train pipe	70	lbs.
Auxiliary reservoir	70	lbs.
Equalizing reservoir	70	lbs.
Brake cylinder pressure equalizes at	50	lbs.

Q. The pressures extend from where to where, and what are they used for? A. Main reservoir pressure extends from the discharge valves of the air pump to the rotary valve of the automatic brake valve, and is used to charge and recharge the train pipe; operate the straight air brake; operate the pump governor, sander, and red hand on the gauge.

Q. Train pipe pressure? A. Extends from the feed valve to the face of the triple piston and is used to charge the auxiliary reservoir apply and release the brakes.

Q. Auxiliary reservoir pressure? A. Extends from the back of the tripple piston to the slide valve, and is used to supply the brake cylinder, to apply the brakes.

Q. Brake cylinder pressure? A. Extends from the tripple slide valve to the tripple exhaust, or retaining valve.

Q. Equalizing reservoir pressure? A. Extends from Chamber D in the automatic brake valve to the black pointer on the gauge, and is used to draw from to start the brakes to apply in service.

Q. What causes the air brake to operate? A. A variation of pressures.

SLIDE VALVE FEED VALVE.

Q. Where is the feed valve located with the quick-action or G-6 brake valve? A. Attached to the brake valve.

Q Where is the feed valve located with the E T-6 equipment and H-6 brake valve? A. On a pipe leading from the main reservoir pipe to the automatic brake valve.

Q. What is the feed valve's duty? A. To control the train pipe pressure.

Q. What are the essention parts of the feed valve? A. The supply valve, supply valve piston, regulating valve, regulating spring, diaphragm, supply valve and piston spring.

Q What is the normal position of this valve? A. Closed.

Q. When open, how does air get into the train pipe? A. Both direct and indirect.

Q. How many parts has the feed valve? A. Two; a supply part and a regulating part.

Q. If a supply piston spring was weak or broken, what would occur? A. Main reservoir and train pipe pressures would equalize.

Q. If the regulating valve could not seat, what would occur? A. The supply valve would not go to normal positon, and main reservoir and train pipe pressures would equalize.

Q. If the regulating valve was closed, what would occur? A. If the pressure in the train pipe was light the supply valve piston would move toward Chamber E, but would quickly return to normal position, cutting the feed valve out of service.

Q. What effect would a leaky supply valve have? A. Overcharge the train pipe.

Q. A leaky cap nut would do what? A. Overcharge the train pipe.

Q. What effect would a leaky feed valve gasket have, if leaking between the ports? A. Equalize main reservoir and train pipe pressures.

Q. If with the automatic brake valve handle in running position the train pipe pressure runs too high, where would you look for the cause? A. In the feed valve.

Q. If with the automatic brake valve handle in running position you get no train pipe pressure, where would you look for the trouble? A. In the feed valve.

Q. Is there any difference in the B-6 and C-6 feed valve? A. They are the same, except that the B-6 feed valve has a thumb wheel attached to the tension nut by which the feed valve may be quickly adjusted for either low or high train pipe pressure.

Q. Explain the operation of the feed valve. A. With the automatic brake valve handle in running position main reservoir air passes through Port F in the rotary valve and through a passage leading to the feed valve. On entering the feed valve it forces the supply piston back, which takes with it the supply valve, uncovering Port B in the slide valve seat, and main reservoir pressure flows direct into train pipe; at the same time main reservoir air is leaking past the supply piston into Chamber E, and through Port A past the regulating valve against the diaphragm and joins the air that is passing direct through Port B. This is the direct way. The direct way charges the train pipe. The indirect way shuts it off. As soon as the train pipe pressure becomes slightly greater than the tension of the regulating spring the diaphragm is moved back, compresses the regulating spring, which allows the regulating valve to be seated. This done the pressure in Chamber E will quickly equalize with main reservoir pressure, when the supply piston spring will expand, force piston and slide valve to normal position, shutting off the direct way and the train pipe pressure will be retained according to the tention of the regulating spring of the feed valve.

TRAIN PIPE.

Q. There is a pipe which extends the full length of each car, tender and engine, what pipe is it? A. The train pipe.

Q. What size pipe is it? A. 1¼ inches.

Q. What is attached to each end of this piece? A. A sleeve.

Q. Why is a sleeve attached? A. If the end of the pipe becomes damaged the sleeve may be easily replaced without interfering with the train pipe.

Q. Are there any cut-out cocks on this pipe? A. Yes; one on each end.

Q. What kind of cocks are they? A. Angle cocks.

Q. Why do we call these angle cocks? A. Because they are cast in an angle.

Q. To what is the hose connected? A. To the angle cock.

Q. If the hose couplings leak, how can it be remedied? A. Drive a thin wooden wedge behind the lugs of the coupling.

Q. Are there any pipes branching from the train pipe on a freight car?. A. Yes; one.

Q. Where does it lead to? A. To the tripple valve.

Q. What size is the branch pipe? A. One inch.

Q. Is there a cut-out cock in the branch pipe? A. Yes.

Q. What size is the cut-out cock. A. ¾ of an nich.

Q. What is the cut-out cock used for? A. To cut out the brake if it becomes defective.

Q. How would you proceed to cut out a defective brake? A. Close the cut-out cock in the branch pipe; drain the auxiliary reservoir.

Q. Why drain the auxiliary and card it? A. To prevent the brake from leaking on.

Q. If the trouble is in the triple valve, auxiliary or brake cylinder, what color card would you use? A. Manilla—a light card, properly filled out, stating the defects.

Q. If the train pipe or branch pipe between the train pipe and the cut-out cock was broken, what color card should you use? A. A red card, properly filled out, stating defect.

Q In either case, where should the card be placed? A. Fasten to branch pipe close to the cut-out cock.

Q. Why fasten to branch pipe near cut-out cock? A. At that point it is most likely to be seen, and a trainman or inspector going over a train can quickly see why the brake is cut out.

Q. How many branch pipes lead off from the train pipe on a passenger car? A. Two.

Q. Where do they lead to? A. One to the triple valve and one to the conductor's valve.

Q. Is there a cut-out cock in the branch pipe leading to the Conductor's valve? A. No.

Q. On some Pullman and on private cars are there more than two branch pipes leading from the train pipe? A. Yes; some Pullman and private cars have three branch pipes; one leads to the triple valve and one to a Conductor's valve on each end of the car.

Q. Why are such cars equipped with two Conductor's valves? A. To avoid running a line of cord through the car.

Q. How many branch pipes lead from the train pipe on engine and tender? A. Three.

Q. Where do they lead to? A. One to the automatic brake valve; one to the triple valve on the engine and one to the triple valve on tender.

Q. Do these branch pipes have cut-out cocks? A. There is a cut-out cock located in each branch pipe leading to the tripple valves, and if the Westinghouse cut-out cock is used, it is located in branch to the brake valve; but if the P. R. R. cut-out cock is used, it will be located in the main reservoir pipe; then there will be no cut-out cock in the branch pipe leading from the train pipe to the automatic brake valve.

Q. If the branch pipe on a passenger car breaks between the train pipe and the cut-out cock, how will you fix it with the least detention? A. Take the piece of pipe next to the

triple valve, reverse it, fasten it into the train pipe. Be sure the cut-out cock is closed, bleed the auxiliary and go ahead.

Q. How about the carborater lights? A. If the non-return check seats properly, the lights will burn for four hours. I know of no way to charge the carborator tank.

Q. If the train pipe is broken on a passenger car, how can you arrange to supply the cars back of it with air? A. Couple the train pipe and air signal hose together, and pass the air to the cars in the rear through the signal pipe.

Q Can you couple the signal hose and train pipe hose with your hands? A. No; they must be drove together. The air signal hose coupling is smaller than the train pipe hose coupling.

Q. Why is one coupling made smaller than the other? A. To prevent mistakes being made in coupling up the wrong hose when trainmen are making up trains.

Q. If a car has a broken train pipe so as it could not be used, how would you arrange to take the car along in the train? A. Drill it in on the rear end.

Q Before placing the car on the rear end, what would you look for? A. See that the car has a good hand brake.

Q If it does not have a good hand brake, what will you do with it? A. Place a car behind it that has a good hand brake.

Q Would you couple the hose on the front end of the defective car? A. Yes; close the angle cock on the front end of the defective car; couple the hose and turn the air in.

Q. Why would you do this? A. If the defective car should break off, it would apply the brakes on the train. If it is a passenger car, the signal hose must be coupled up; then if the car breaks off at that point, there will be one long blast of the signal whistle.

Q. Does the train pipe air pass through any strainers

before it reaches the triple valve? A. Yes; two.

Q. Where are they located? A. One at the union of the branch pipe, the other at the triple valve.

Q. What must be done at the end of the trip, when you couple air hose and signal hose together? A. It must be reported the couplings being of different sizes, will be damaged and may have to be replaced.

TRIPLE VALVES.

Plain Triple Valves.

Q. How many kinds of triple valves are used? A. Two.

Q. What are they? A. Plain and quick action.

Q. How many operative parts has the plain triple? A, Three.

Q. Name them? A. Triple piston, graduating valve and slide valve.

Q. What is the duty of the triple valve? A. To control the flow of air to and from the auxiliary reservoir to and from the brake cylinder, to apply and release the brakes.

Q. How many positions has the plain triple? A. Four.

Q. Name the positions? A. Release, service, lap and emergency.

Q What is the duty of the triple piston? A. To open and close the train pipe, feed port, seat and unseat the graduating valve and move the slide valve.

Q. How many square inches has the front of the triple piston? A. Nine square inches.

Q. What pressure is in front of the triple piston? A. Train pipe pressure.

Q. What pressure is back of the triple piston? A. Auxiliary reservoir pressure.

Q. When the pressures are equalized and a train pipe reduction is made, what is the first thing the triple piston does when it moves? A. Closes the train pipe feed port and unseats the graduating valve.

Q. After the piston has closed the feed port and unseated

the graduating valve, is the brake applying? A. No; not until the slide valve is moved to register its service port with the port in its seat.

Q. Then the triple piston has three duties to perform? A. Yes; it closes the feed port, seats and unseats the graduating valve and moves the slide valve.

Q. What is the duty of the graduating valve? A. The graduaitng valve is only used in making a service application of the brake, and its duty is to automatically measure the flow of air from the auxiliary reservoir to the brake cylinder.

Q. What is the duty of the slide valve? A. Its duty is to register its ports with the port in its seat.

Q. What port does it register in applying the brake? A. Port that communicates the auxiliary reservoir and brake cylinder pressures.

Q. What port does the slide valve register in releasing the brake? A. It registers the brake cylinder to the atmosphere by way of a groove in the slide valve.

Q. What is the letter of the old style triple valve? A. H. 24.

Q. Where are they usually fund? A. On small cars and small tenders.

Q. Where is the cut-out cock located on the old style plain triple? A. In the body of the triple.

Q. How many positions has the handle of the cut-out cock? A. Three; straight air, automatic and cut-out.

Q. Explain the positions? A. Handle perpendicular in line with pipe for straight air; horizontal cross ways of pipe for automatic, and half way between perpendicular and horizontal to cut-out.

Q. If with the cut-out cock in cut-out position a blow occurs at the triple exhaust, what causes it? A. The cut-out cock is leaking.

Q. To apply the brakes, then cut-out a brake with the old style plain triple, can the brake be released by bleed-

ing the auxiliary reservoir? A. No.

Q. How could the brake be released? A. Cut in, release the brakes in the usual way, then cut-out.

Q. How many kinds of plain triples are in use? A. Two.

Q. What are they? A. The old style H. 24, with the cut-out cock in the body of the valve, and can be used in either straight air or automatic, and the improved plain triple with the cut-out cock in the branch pipe. This is the F. 46 triple and can be used in automatic only.

Q. Is there any difference in the old style and the improved plain triple aside from the cut-out cocks? A. The only difference is the improved plain triple is larger. It has the same operative parts and the same positions as the old style triple.

Q. Where is the improved plain triple always found? A. On driver brakes on an engine.

Q. Why are plain triples used on driver brakes? A. The P. R. R. does not want a high brake cylinder pressure on the driver brakes.

Q. With an old style triple on tender cut in for straight air, and an improved plain triple on driver brace, how would it work? A. With automatic brake valve handle in release or running position, the engine brake will be released and the tender brake applied. In emergency position the engine brakes will be applied and the tender brakes will be released. The old H. 24 will work in harmony with any other triple valve if cut in for automatic; but on the P. R. R. its becoming to be a thing of the past.

Q While a plain triple has an emergency position, can we get an emergency application of the brake with a plain triple? A. No; while the triple piston and slide valve both stop in the emergency position, when a quick, sudden train pipe reduction is made, and the slide valve clears the port in its seat, it opens direct communication between the auxiliary and brake cylinder through a larger port than the service port in the slide valve, hence with the standard

5-inch driver brake piston travel, we get a full equalization of auxiliary pressure in the driver brake cylinder which is 50 lbs. per square inch, from a 70-lb. train pipe pressure. The only difference between a full service and an emergency application, we get the brake applied a little quicker in the emergency, but not any harder.

Q As the triple piston responds to a train pipe reduction, and moves out bringing with it the slide valve, what stops it? A. The graduating stem.

Q What holds the graduating stem to its place? A. The graduating spring.

Q. What tension has a freight graduating spring? A. About three pounds.

Q Describe a freight graduating spring? A. It is made of piano spring steel or bronze wire, 16 coils, 2¾ inch free heights, 29-62 inside diameter.

Q. The graduating spring in a passenger triple is what? A. Is made of piano spring steel wire 48-1000 of an inch in diameter, 13¼ coils—2¾ free heights and 29-62 inside diameter with a tension of about 5 lbs.

Q. Why is a passenger graduating spring heavier than a freight? A. On account of being used on short trains.

Q. We say the knob on the triple piston came against the graduating stem and was stopped. How long will it remain there? A. Until the auxiliary pressure is slightly reduced below the train pipe pressure.

Q. What occurs then? A. The piston moves back and seats the graduating valve.

Q. What position is this? A. Lap position.

Q. How far does the piston move before the graduating valve is seated? A. 3-16 of an inch.

Q. Then if a 5-lb. train pipe reduction is made, how much air will pass from the auxiliary to the brake cylinder? A. Slightly more than 5 lbs.

Q. To make a further reduction of 5 lbs. what parts of the triple valve will move? A. The piston will move out

against the graduating stem again taking with it the graduating valve, and more air will flow from the auxiliary into the brake cylinder.

Q How long can we gain brake cylinder pressure by making light reductions? A. Until auxiliary and brake cylinder pressure equalize.

Q. Then a further train pipe reduction would be what? A. Would only be a waste of air.

Q. The amount of train pipe reduction required to set the brakes full depends on what? A. The piston travel.

Q. With the Standard 8-inch piston travel, what train pipe reduction is necessary to cause an equalization of pressure and set the brakes full? A. 20 lbs.

Q. What reduction is required to set the brakes full with 9-inch piston travel? A. 25 lbs.

Q. What will the auxiliary and brake cylinder pressure equalize at? A. 45 lbs. per square inch.

Q. Why will the brake cylinder pressure be raised to an equalization of 50 lbs. from a 20 lb. reduction? A. On account of the auxiliary reservoir being 2½ times the space in the brake cylinder with the proper piston travel?

Q. What will a 6-inch piston travel equalize at? A. 52 lbs.

Q. Do we get any higher brake cylinder pressure from an emergency application than from a full service application, using plain triple valves? A. Not any higher, but a little quicker.

QUICK ACTION TRIPLE VALVES.

Q. What are the names of the quick action tripple valves, generally used? A. F. 36. Small freight triple. H. 49 large freight triple. F. 27 small passenger triple. F. 29 large passenger triple.

Q. How can we tell a freight from a passenger tripple? A. Freight triple has two exhaust ports; a passenger triple has but one.

Q. How can we tell a large freight triple from a small

freight tripple, they being near the same size? A. The F. 36, the small freight triple has two bolt-holes in the supporting flange and is used on 6 and 8-inch brake cylinder. The H. 49, the large freight triple, has two exhaust ports, and three bolt-holes in the supporting flange used on 10 and 12-inch brake cylinders. The F. 27 has one exhaust port and two bolt-holes in the supporting flange. The F. 29 has one exhaust port and three bolt holes in the supporting flange. The F. 27 and F. 29 are the small and large passenger triples. All quick action triples.

Q. How many operative parts has a quick action triple valve? A. Six.

Q. How many operative parts has a quick action triple that are not in a plain triple? A. Three.

Q. Name them. A. Emergency Piston, Emergency or rubber-seated valve and train pipe check valve.

Q. Then the quick action triple has six operative parts? A. Triple piston, graduating valve, slide valve, emergency piston, emergency valve and train pipe check valve.

Q. How many of these parts move in making a service application of the brake? A. Triple piston, graduating valve and slide valve.

Q. How many of these parts are used in an emergency application of the brake? A. Five; the graduating valve is of no service in applying the brake in the emergency.

Q. How many positions has the quick action? A. Four; the same as a plain triple.

Q. Each operative part has a duty; the first three as explained in the plain triple. What s the duty of the emergency piston? A. To unseat the emergency or rubber-seated valve.

Q. What is the duty of the emergency valve? A. Its duty is to keep train pipe air out of the brake cylinder, when we want it out, and to let it in when we want it in.

Q. The duty of the train pipe check valve? A. Its duty is to prevent brake cylinder pressure from flowing into the

train pipe at any time when the train pipe pressure is below equalization, and in making an emergency application, the train pipe check valve should seat as quickly as the train pipe and brake cylinder pressure equalize.

Q. We say emergency or rubber-seated valve, has the emergency valve a rubber-seat? A. Yes; it has a rubber seat.

Q. How much higher brake cylinder pressure do we get with an emergency application than with a service application? A. 10 lbs.

Q. In a full service application of the brake, we get an equalization of auxiliary pressure of 50 lbs. Where do we get the other 10 lbs? A. From the train pipe.

Q. How does it get into the brake cylinder? A. As the tripple piston moves the slide valve to emergency position, the removed corner of the slide valve uncovers the port leading down on top of the emergency piston and auxiliary air forces the emergency valve down from its seat the train pipe pressure will then lift the train pipe check valve and a flash of train pipe air will pass the train pipe check valve and emergency valve into the brake cylinder.

Q. How long will train pipe air continue to flow into the brake cylinder? A. Until equalization occurs between the brake cylinder and train pipe pressures.

Q. How long a time is required for equalization? A. About three seconds to the 50th car in the train.

Q. Then we say we get 10 lbs. from the train pipe first; do we get auxiliary pressure in brake cylinder, too? A. Yes; after getting 10 lbs. from the train pipe, wet get an equalization of auxiliary pressure from a 70-lb. pressure which builds the brake cylinder pressure to 60 lbs. per square inch

Q. Then we get 60 lbs. brake cylinder pressure from a 70 lbs. train pipe pressure; what do we get from a 110 lbs. train pipe pressure? A. From 85 to 88 lbs. per square inch brake cylinder pressure.

Q. We say the train line check valve seats when train nove them to their normal position when equalization ›ccurs between the auxiliary reservoir and brake cylinder.

Q. How many ports are there in the slide valve? A. Two; the service and the emergency ports.

ine and brake cylinder pressure equalize; where does the :mergency piston and emergency valve resume their normal ›osition? A. The spring under the emergency valve will

Q. Which of these ports is the larger? A. The service ›ort.

Q. Why is the emergency port smaller? A. To retard he flow of auxiliary air, which gives the train pipe air a chance to get into the brake cylinder first in making an :mergency application of the brakes.

Q. How long will it take to charge an auxiliary reservoir from 0 to 70 lbs. with a constant train pipe pressure of 70 lbs? A. From 1½ to 2 minutes.

Q. Can 5 cars be charged as quickly as one? A. Yes.

Q. Can 50 cars be charged as quickly as 5 cars? A. No; you cannot maintain the high train pipe pressure. If the pressure could be maintained on a 50-car train pipe, 50 cars could be charged as quickly as 5 cars.

Q. Why does it take so long to charge an auxiliary? A. On account of the air having to pass through the small feed groove in the tripple bush.

Q. Why is this groove made so small? A. To cause a uniform recharge.

Q. What size is the feed groove? A. Its the half of a circle of 148-1000 of an inch, and will feed at the rate of 1 lb. per second from a 70 lbs. pressure.

Q. What would be the effect of a leaky graduating valve? A. With tripple on lap, a leaky graduating valve would raise the brake cylinder pressure to equalization.

Q. What would be the effect of a leaky check valve? A. Brake would leak off if applied in the emergency.

K TRIPLE VALVE.

Q. How can you tell a K triple valve from other triples? A. By the fine cast on the back of the triple.

Q. Will a K triple work in harmony with other triple valves? A. Yes.

Q. Are K triples used in passenger service? A. No; they are freight triples.

Q. To what quick action triples may a K triple be substituted? A. The K-1 triple may take the place of an F-36 and the K-2 triple the place of an H-49.

Q. By what other name are they known? A. The H-1 and H-2

Q. How are we to know these triples apart, one from the other? A. A K-1 has two bolt holes in the supporting flange, while the K-2 has three bolt holes in the supporting flange.

Q. Explain the difference? A. The F-36, K-1 or H-1 are small freight triples, each having two bolt holes in the supporting flange, used with the smaller freight auxiliary reservoir, and an 8-inch brake cylinder. The H-49, K-2 or H-2 has three bolt holes and may be used with the larger size auxiliaries and 10-inch brake cylinders.

Q. How many operative parts has the K triple? A. Six, and retarding device.

Q. Name them. A. Piston, graduating valve, slide valve, emergency piston, emergency valve and train pipe check valve.

Q. How many positions has the K triple valve? A. Seven.

Q. Name the positions? A. Release, retarded release, quick service, quick service lap, full service, full service lap and emergency.

Q. What are the features claimed for the K triple over that of the quick action triple? A. Quick service, uniform release, uniform recharge and retaining feature.

Q. Is there any difference between the K-1 and the K-2

triple valves? A. Yes; the K-1 does not have the Port Y charging port; Port Y charging port is in K-2 triples only.

Q. Explain how air passes through the K triple in full release position. A. The slide valve opens communication from the brake cylinder to the atmosphere, with a full exhaust and air passes through the feed groove from the train pipe to the auxiliary reservoir, and from the train pipe past the train line check valve, then through Port Y and through a port in the slide valve into the auxiliary reservoir, thus feeding two ways into the auxiliary.

Q. In retarded release position? A. A groove being milled in the face of the slide valve, this groove being brought to register with the port leading from the brake cylinder to the atmosphere, thus the exhaust is retarded. While in this position the shoulder on the auxiliary side of the tripple piston is forming an air tight joint between the train pipe and the auxiliary. In this shoulder is a smaller

Q. Are quick action triples satisfactory on train of over 50 cars? A. No.

Q. Why? A. Too great a number of triples do not respond to a light reduction on a long train.

Q. Will a greater per cent. of brakes be set with the K triples? A. Yes.

Q. Why? A. As each K-2 triple vents train pipe air to the brake cylinder, this assists the train pipe reduction on the following triple. Hence the effect of a light reduction will be greater on the rear of a long train than could be caused by the same train pipe reduction when equipped with the old style triples, and a greater number of brakes will be set.

Q. In releasing the brakes on a 50-car train, about how many triples will go to retarded position? A. About 30.

Q. What other advantage is there by a slow recharge on the triples that have gone to retarded release position? A. It causes a higher train pipe pressure to be built up on the

rear end of the train and insures a more prompt release of the brakes.

Q. Why can the pressure not be raised on the rear end of a train as quickly as on the front end, having a large main reservoir volume? A. On account of the crooks and bends in the train pipe and hose connections which cause a frictional resistance.

Q. Would the blow at the train pipe exhaust be as long with a train of K triples as with the old style triples? A. No; with the K triple each triple vents a portion of the train pipe air to the brake cylinder which will decrease the train pipe exhaust about one-half on a long train.

Q. With an emergency application, what brake cylinder pressure do we get with the K triple? A. About 60 lbs. per inch.

Q. Does the K triple apply the brake quicker and harder than the quick action triple? A. Yes; about 50 per cent quicker, and 30 per cent. harder from a high service reduction.

Q. How long a time is required to apply the brakes in the emergency on a train of 50 cars? A. About three seconds.

Q. Can you release the brakes after an emergency application the same as after a service application? A. Yes; but owing to the low train pipe pressure, it will take longer.

Q. Has the graduating spring the same strength as the retarding spring? A. No; the retarding spring is the heavier and stronger.

K TRIPLE VALVE DEFECTS.

Q. What is usually the cause of troublesome triples? A. Tripples become dirty or dry.

Q. What effect will a leak in the auxiliary have? A. With brakes released it is a waste of air; with brakes applied it will release them.

Q. If the emergency valve or train pipe check valve

gasket is leaking, will it cause a blow at the triple exhaust while the brakes are applied? A. No.

Q. What will such a leak cause? A. It will cause the brake cylinder pressure to build up to an equalization of train pipe pressure.

Q. If an auxiliary leak causes a blow at the triple exhaust, will it blow when the brakes are applied? A. A leaky slide valve will sometimes cause a blow when the brakes are applied, but a leaky gasket for an auxiliary tube will not cause a blow at the triple exhaust when the brakes are applied.

Q. Why do some brakes not apply when a light reduction is made? A. Some tripples being dirty or dry which causes undue friction, thus not being sensitive to a light reduction and the auxiliary pressure leaks back into the train pipe, or the brake cylinder piston may not be moved far enough to close the leakage groove.

Q. What parts of a triple will cause an auxiliary leak? A. Body gasket, slide valve or auxiliary tube .

Q. What will cause a train pipe leak through the triple valve? A. The train pipe check valve gasket or emergency valve.

Q. If a blow occurs at the tripple exhaust, how can you tell if it is an auxiliary or a train pipe leak? A. By closing the cut-out cock and wait a moment. If the brake that is cut out applies of its own accord and the blow stops, it is a train pipe leak. But if the brake does not apply, it is an auxiliary leak and the blow will not cease.

Q. Will a leaky auxiliary tube apply or release the brakes? A. It has a tendency to release the brakes.

Q. Occasionally you notice a buzzing sound within a triple valve. What causes it? A. It is caused by the train pipe check valve lifting and seating in rapid succession caused by an auxiliary leak or by the emergency valve being unseated. A jar on the side of the valve body will often seat the emergency valve and the noise will stop.

Q. What effect will a bad piston packing ring have? A. If the packing ring fits loosely in the bush, it has a tendency to not respond to a light reduction, back in a long train, or if applied, it may not release.

Q. Is undesired quick action caused by dry or gummy tripples? A. Yes; a dry or gummy tripple is not sensitive, and a light reduction will only move the piston part way between release and service positions; then a second reduction will cause a sufficient difference in pressure to move it, and it is forced to emergency position.

Q. What effect would a broken or weak retarding spring have? A. It would allow the piston to go to retarded release position every time the brakes were released, causing a very slow release of that brake

Q. Why does the K triple go to full release sometimes and retarded release at other times? A. By building up the train pipe pressure slowly, the triple piston will stop in full release postion; but by building it up quickly, the piston will be forced to retarded release position.

Q. If you had an engine and a few cars doing some shifting work, how could you release the brakes promptly to make quick moves? A. In releasing the brakes, move the brake valve handle to running position, not to release position.

Q. How long does it take to charge an auxiliary reservoir with a K triple valve in retarded release position? A. About 250 seconds.

Q. How long does it take with a K triple in full release position? A. About 70 seconds.

PISTON TRAVEL.

Q. What is the proper piston travel on cam driver brakes from 1½ to 3 inches? A. Equalized driver brakes from 4 to 6 inches, engine truck brake from 5 to 7 inches, tender brake from 6 to 9 inches, freight car 7 to 9 inches, passenger car (steel wheels) 6 to 9 inches, cast-iron wheels 7 to 9 inches. The piston travel on freight cars by special

instructions, is 5 to 7 inches.

Q. If the piston travel measures 8 inches standing, what will it measure running? A. 9½ to 10 inches.

Q. In applying the brakes having proper piston travel, what stops the brake cylinder piston from going against the cylinder head? A. The shoes against the wheels.

Q. What stops the piston if it has a very long travel? A. The non-pressure head of the brake cylinder.

Q. Would this be a holding brake? A. No; the shoes may not be couching the wheels.

Q. Why is the leakage groove in a brake cylinder? A. To allow any air that may leak into the brake cylinder to escape by the piston and not set the brakes.

Q. How long is the leakage groove? A. 3¼ inches

Q. If the brake piston only travels 3 inches, would this be a holding brake? A. No; the air would pass around the piston through the leakage groove, and the brake would not apply at all.

HIGH SPEED BRAKE

Q. What is meant by hingh speed brake? A. Higher pressure.

Q. Is there any material change in the system required to get this high pressure? A. No.

Q. How can we convert a low speed brake to a high speed brake? A. By setting the pump governor to carry 140 lbs. main reservoir pressure, set the feed valve to carry 110 lbs., trainpipe pressure, and attach an automatic reducing valve to each brake cylinder.

Q. What is understood by high speed brake? A. The primary feature is an emergency brake.

In how much shorter distance can a train running 60 miles per hour be stopped with a high speed brake than with a low speed brake? A. With an emergency application of a high speed brake, a swift running train can be brought to a stand still in about two-thirds of the distance, or about 30 per cent quicker than with a low speed

brake.

Q Has it any other advantage? A. Yes; with 110 lbs. train pipe and auxiliary pressure, it enables two or three service applications without recharging, and have auxiliary pressure for an emergency application if desired.

Q With a high speed brake what pressure do we get in the brake cylinder from an emergency application? A. With the proper piston travel we get 88 lbs. per inch.

Q With a heavy application why do we get only 60 lbs. brake cylinder pressure? A. The automatic reducing value is set at 60 lbs. and will vent all pressure above 60 lbs. to the atmosphere.

Q. Explain why a brake cylinder pressure of 88 lbs. per inch does not slide the wheels? A. It is almost impossible to slide a wheel revolving at high speed. The 88 lbs. pressure is applied when the speed is the highest as the speed is being reduced. As the speed is being reduced the reducing valve is also reducing the brake cylinder pressure; and as the friction is becoming greater between the shoe and the wheel, the speed and pressure are both reducing the train will stop with a 60-lb. brake cylinder pressure.

Q. Do we get any higher brake cylinder pressure from a 10-lb. train pipe reduction, from a 110-lb. train pipe pressure than from a 70-lb. train pipe pressure? A. No; may get it quicker, but not heavier. You take a pound of sugar from a bucket—you have a pound. You take a pound of sugar from a barrel and you have just one pound.

Q. Is the high speed used in all kinds of service? A. No; in passenger service only.

Q. Why is the brake cylinder pressure not reduced below 60 lbs.? A. Because the automatic reducing valve is set at 60 lbs.

Q. How long will it take the reducing valve to reduce the cylinder pressure from 88 to 60 lbs.? A. From 18 to 26 seconds.

Q. Is it a speed reducer or a time reducer? A. A time

reducer.

Q. Are we allowed to use high pressure on engine tender or cars not equipped for it? A. No.

Q. Could we use the emergency at low speed? A. No; we would slide the wheels, and sliding of wheels are not holding wheels. We would get better results by making a service application.

HIGH PRESSURE CONTROL
(Or Schedule U.)

Q. What is meant by high pressure control? A. A system which can quickly be changed from low to high pressure.

Q. Is it a freight or passenger equipment? A. For freight only, used on mountain, or on roads where very heavy loaded cars are taken down steep grades. A device designed especially for heavy trains.

Q. May the modern brake be modified to be used as a schedule U? A. Yes.

Q. What apparatus is necessary to attach to the modern brake to have a Schedule U? A. Reversing cock and bracket, two feed valves, a duplex pump governor and a safety valve attached to each brake cylinder.

Q. What pressures are used and how are they gained? A. As each road may have a standard of its own, the pressures may vary; so we say we adjust one governor top to 100 lbs. and one feed valve to 70 lbs. This will be the connection for the low pressure, with the reversing cock handle to the left. The other governor top we adjust to 130 lbs. and the other feed valve to 100 lbs. This is the connection for the high pressure with the reversing cock handle to the right, so you can quickly change the pressures from low to high, or from high to low.

Q. How does it operate? A. On roads that are partly level and partly mountainous, carry the handle of the reversing cock to the left while running on the level. This will give you 100 lbs. main reservoir pressure and 70 lbs.

train pipe pressure. Before descending a grade (giving sufficient time to charge the auxilliaries from 70 to 100 lbs.), turn the handle of the reversing cock to the right. This will cut out the low pressure governor top and low pressure feed valve, and cut in the high pressure governor and feed valve. This will give you a main reservoir pressure of 130 lbs. and a train pipe pressure of 100 lbs.

Q. How can the two feed valves be attached to the brake valve? A. The two feed valves are atached to the reversing cock bracket and piped to bracket attached to the brake valve.

Q. By changing the reversing cock, does it change the feed valve? A. It changes from one to the other.

Q. Does the Schedule U require any change in the equipment on the cars? A. No.

Q. What would happen if the reversing cock should leak? A. The pressures would vary and interfere with the use of the brake.

Q. Is there danger of heating the tire or sliding wheels when the brake cylinder pressure is built up high? A. No; the safety valve attached to the brake cylinder will take care of the high pressure.

Q. If you have a few light cars in the train would you use the high pressure on them, or would you use the low pressure? A. Cut the brakes out on the light cars and use the high pressure.

Q. Can the high pressure control, or Schedule U be used on any railroad? A. Yes; and it is speedily being adopted by the various railroads throughout the country.

RETAINING VALVES.

Q. Why are retaining valves used? A. To retain a certain amount of pressure in the brake cylinders while recharging the auxilliary reservoirs when decending heavy grades.

Q. Has the retaining valve any other features? A. It gives increased brake cylinder pressure higher braking

power and insures more safety in handling trains on heavy grades.

Q. To what is the retaining valve attached? A. Attached to a pipe leading from the exhaust port of the triple valve.

Q. Where is it located? A. At the end of a car near the brake wheel.

Q. Why is it located there? A. For convenience to trainmen.

Q. How many styles of retaining valves are in general use? A. Two.

Q. Name them. A. The two position, 15" retainer and the three position, 25 and 50" retainer.

Q. When the handle of the 15-lb. retainer stands horizontal, what number of pounds will it retain in the brake cylinder from a full service application of the brake? A. 15 lbs.

Q. What sized brake cylinders is the 15-lb. retainer used with? A. 6, 8 and 10-inch cylinders.

Q. What sized cylinders is the 25 and 50-lb. retainer used with? A. 10, 12, 14 and 16-inch cylinders.

Q. What grade should the 50-lb. retainer be used on? A. On grades of not les that 2½% and then on heavily loaded cars only.

Q. Are there any grades on the main line of the Pittsburgh division of the P. R. R. where 50-lb. retainers could be used? A. Between Gallitzin and Altoona, on the east slope of the Alegheny mountains.

Q. Are there any branches belonging to the Pittsburgh division where 50-lb. retainers could be used? A. Dunlo to Lovett, Salix to Lovett, and on the Brilliant and Yough branches.

Q. How does a retaining valve operate? A. With a handle turned down, there is a clear exhaust through the retainer, and air from the brake cylinder can pass freely to the atmosphere.

Q. When the handle is turned up, does the air pass through a larger or smalled port? A. Through a smaller port.

Q. Where is the escape port located? A. In the retainer cap.

Q. Is the escape port of the same size in all retainers? A. No; the 15-lb. retainer escape port is 1-16 of an inch in diameter. The 25 and 50-inch retainer has a 1-8 inch port.

Q. With these small escape ports, to make a full service application and release, how long will it take for the brake cylinder pressure to reduce down to the limit of the weighted valve? A. From 30 to 50 seconds.

Q. With a 3-position retaining valve, how must the handle be to retain a 25-lb. pressure in the brake cylinder? A. Horizontal; an angle of 90%.

Q. To retain a 50-lb. brake cylinder pressure? A. Half way—an angle of 45%.

Q. To apply the brakes, turn up the handle of the retainer, then release the brakes; in a few minutes, turn the handle down. But you hear no exhaust from the retainer. What is the trouble? A. A leak in the brake cylinder or retainer pipe.

Q. On what class of cars does this most frequently occur? A. On refrigerators where salt water comes in contact with the retainer pipe.

Q. If with the handle turned down the brakes fail to release, where would you look for the trouble? A. The exhaust port in the retainer may be stopped up.

Q. If there is a constant leak at the retainer, where would you find the cause? A. In the triple valve—the emergency valve being unseated—leaky slide valve or leaky gasket, either of these would cause a leak at the retaining valve.

AIR SIGNAL SYSTEM

Q. How many pipe lines are there on a passenger car? A. Two.

Q. What line of pipes are they? A. Train and signa pipe.

Q. Are these pipe lines the same size? A. No; the train is 1¼ inch, and the signal is 7-8 of an inch.

Q. Why is the signal pipe the smaller? A. It carries a smaller volume of air, and a blast from the car discharge valve will make a more sudden reduction than if the volume was larger.

Q. Are there any cut-out cocks located in the signal pipe? A. Yes; one at each end of the car.

Q. What kind of cut-out cocks are they? A. Straight, plug cocks.

Q. What pressure is carried in the signal pipe? A. 40 lbs.

Q. What pressure is the 40-lbs. taken from? A. From main reservoir pressure.

Q. What kind of a valve is used to reduce this pressure to 40 lbs.? A. A reducing valve; sometimes a C-6 reducing valve is used.

Q. Where is the reducing valve located? A. Usually inside of cab to protect it in winter.

Q. Will a reducing valve freeze up? Why? A. The reducing valve being located near the main reservoir where moisture is likely to work into it, it is liable to freeze up in severe winter weather.

Q. Are there any other valves used on the signal system? A. Yes; the signal valve and car discharge valve.

Q. Where is the signal valve located? A. Uusally inside of the engine cab.

Q. Where is the car discharge valve located? A. Above the door under the hood.

Q. What is the duty of the signal valve? A. It controls the flow of air to the whistle.

Q. How many operative parts has it? A. Two; a rubber diaphragm and signal valve stem.

Q. Describe the operation of the signal valve. A. Air

passes in at the top of the signal valve through a small port into Chamber A, above the diaphragm. Air also passes through a pasage in the body of the valve into Chamber B under the diaphragm. Chamber B has a larger volume than Chamber A. The signal valve is seated. The valve stem is a neat fit for 1-32 of an inch only at the top. The balance of the stem is milled out. The signal valve being charged up a reduction in Chamber A will allow Chamber B volume to raise the diaphragm which will unseat the valve stem, and air from chambers A and B will flow to the whistle and cause it to sound.

Q. What causes the whistle to stop sounding? A. The same reduction that caused the whistle to sound caused the reducing valve to open, and the signal pipe is recharged which forces the diaphragm down ad seats the signal valve, thus cutting off the flow of air from the whistle.

Q. If with the signal pipe charged at 40 lbs., but there is no air in the signal valve, where would you look for the trouble? A. The small port in the top of the signal valve is stopped up with dirt.

Q. If the signal valve is charged, but the whistle will not sound, where is the trouble? A. The trouble is in the whistle. It may not be properly adjusted; something may be obstructing it, or a strong draft of air may be striking it.

Q. If the conductor opens the discharge valve twice, and the whistle sounds but once, what is the trouble? A. The diaphragm stem is too neat a fit.

Q. If the conductor opens the discharge valve once, and the whistle sounds twice, where is the trouble? A. The diaphragm stem is too loose.

Q. If the conductor opens the discharge valve on the 5 car, but the whistle will not respond, he goes to the first car, opens that discharge valve and the whistle will sound, what is wrong now? A. A baggy diaphragm in the signal valve.

Q. While riding in a passenger car you see the con-

ductor pull the signal cord, at the first pull you hear a strong blast of air at the valve; at the second pull the blast is small, at the third pull there is no blast. What is the trouble? A. The strainer at the union of the signal pipe and branch pipe is almost closed.

Q. Will the whistle sound? A. No.

Q. Why? A. There has been no signal pipe reduction.

Q. If when releasing the brakes the whistle sounds, what causes it? A. The reducing valve is set too high. The signal pipe is overcharged.

Q. While the engine is standing alone and occasion you hear a blast of the whistle, what is causing it? A. Leaks in the signal line.

Q. Is there a cut-out cock in the reducing valve? A. Yes; the main reservoir pressure may be cut away from the signal system.

Q. If you couple to a train, and in due time the inspector tells you there is no air coming back through the signal line, what would you do? A. Uncouple the signal hose between the tender and the first car. If there is no air pasing back through the signal pipe or tender, the cut-out cock in the reducing valve may be closed; but if the cut-out cock is found to be open, stop the pump, drain thet main reservoir, uncouple the feed pipe to the reducing valve and you will find the feed port in the reducing valve is closed with dirt.

Q How many pipes lead from the signal pipe on an engine? A. One, which leads to the signal valve.

Q. How many pipes lead off on a car? A. One, which leads to the car discharge valve.

Q Is there a cut-out cock in the pipe leading to the signal valve? A. No.

Q Is there a cut-out cock in the pipe leading to the car discharge valve? A. Yes.

Q. Name the operative parts of a car discharge valve. A. Discharge valve, spring and handle.

Q. How does it operate? A. The rope is atached to the handle; by pulling the discharge valve is unseated which allows signal pipe air to escape to the atmosphere, thus causing a reduction in the signal pipe.

Q. How should the car discharge valve be operated? A. Pull the cord for one second; then let it be closed for three seconds before pulling it again.

Q. Why let it be closed for three seconds between pulls? A. To allow the pressure to be equalized.

SIGNALS.

Q. What kind of signals are these? A. Communicating signals.

Q. What does one blast of the whistle mean while the train is running? A. There is a brake sticking on the train.

Q. Two blasts while standing? A. To start.

Q. Two blasts while running? A. Stop at once.

Q. Three blasts while running? A. Stop at next station.

Q. Three blasts while standing? A. Back the train.

Q. Four blasts while running? A. Reduce speed.

Q. Four blasts while standing? A. Apply the brakes; if applied, release them.

Q. Five blasts while running? Increase speed.

Q. Five blasts while standing? A. Call the flag.

Q. When ready to leave a terminal and you would receive two blasts of the whistle, would you start? A. No; not until I would receive a hand signal from the crew.

Q. While running along and the whistle sounds occasionally, what is causing it? A. There is a leak in the signal line, and when striking a curve or bad track this leak will increase sufficiently to make a sudden reduction and the whistle will sound.

Q. If when coupled to a very short train, say, two cars,

and a reduction is made from the second car and the whistle will sound, but to couple a few more care on the whistle will not sound, if tried from the car, where is the trouble? A. There is a very loose stem or a baggy diaphragm in the signal valve. By coupling on more cars increased the volume of the signal pipe, which lightens the reduction and a baggy diphragm will not lift the stem from its seat, and no air can get to the whistle.

Q. What effect will a leaky signal system have? A. It will be a waste of air; cause the whistle to make undesirable sounds and overwork the pump.

DOUBLE HEAD WITH G-6 BRAKE VALVE.

Q. What is the rule for double-heading when two or more engines are coupled together? A. The leading engine must handle the brake.

Q. What must be done with all other engines except the one handling the brake? A. Close the cut-out cock to prevent the main reservoir air from going into the train pipe and releasing the brakes.

NOTE—The Westinghouse cut-out cock is a plain cock located in the train pipe under the automatic brake valve; but the P. R. R. cut- out cock is located in the supply pipe from the main reservoir to the automatic brake valve.

Q. Has the P. R. R. cut-out cock any advantage over the Westinghouse cut-out cock? A. Yes.

Q. Explain. A. The Westinghouse cut-out cock when it is turned to No. 2 position, the brakes can neither be applied or released from that engine.

Q. What pressure does it divide? A. It blanks the train pipe and no air can be put into the train pipe from the main reservoir on that engine. Neither can there be a train pipe reduction made by the brake valve on that engine.

Q. Explain the P. R. R. cut-out cock. A. It is located in the main reservoir pipe and in No. 2 position; it divides the

main reservoir and train pipe pressures.

Q. What pressure seats the rotary? A. Train pipe pressure.

Q. How does train pipe pressure get on top of the rotary valve? A. By way of the circulation pipe.

Q. Then with the cut-out cock in No. 2 position, ports are closed from where to where? A. From the main reservoir to the brake valve, and from the train pipe exhaust to the atmosphere.

Q. With the Westinghouse cut-out cock in No. 2 position, can the brake be applied from the engine cut-out? A. No.

Q. Can the brake be released? A. No.

Q. What pressure seats the rotary? A. Main reservoir pressure.

Q. Would you keep the pump working? A. Yes.

Q. Why would you keep the pump working? A. To be ready in case something should occur to the lead engine. You would be ready to cut in and take the brake.

Q. With the P. R. R. cut-out cock in No. 2 position, can the brakes be applied? A. Yes; in the emergency only.

Q. Can the brakes be released after such an application? A. No; not from the second engine, the one cut out, but the brakes may be released from the lead engine.

Q. In applying the brakes in this way, in which position would you leave the brake valve handle? A. In emergency position.

Q How long would you leave it there? A. Until the train stops.

Q. Then where would you move it to? A. To running position.

Q. Suppose you would leave it in emergency position, what would occur? A. There would be a strong blow at the straight exhaust while the engineer on the lead engine was trying to release the brakes.

Q Would he get the brakes released? A. Not until you would change your brake valve handle to some other posi-

tion which should be running position.

Q. If the second engine in double header had neither Westinghouse or P. R. R. cut-out cock, how would you double-head? A. Keep pump working and lap the brake valve.

Q. If by mistake you would move the brake valve handle to running position, what would happen? A. In a service reduction the brakes would not apply at all, because the second engine would be recharging the train pipe through Port B in the feed valve as fast as the lead engine would

Q. Would this be considered safe? A. No.

Q. How would you do to be safe? A. Insert a blind gasket in union under the brake valve.

Q. And keep the pump working? A. Yes; to keep the rotary seated.

Q. Then when two or three engines are coupled to a train, the cut-out cocks must be closed on all engines except the lead engine. Why? A. To give the man on the lead engine full control of the brakes.

Q. In which position should you carry the handle of a brake valve when cut out with the P. R. R. cut-out cock? A. In running position.

Q. Why? A. So as the train pipe pressure will register on the gauge, then you can tell what train pipe pressure is carried and what reductions are being made.

Q. If the pump on the second engine was not working, would it make any difference in handling the brake? A. No.

Q. We say train pipe pressure seats the rotary when using P. R. R. cut-out cock? A. Yes.

Q. Where does this train pipe pressure come from? A. From the lead engine. Passes through the circulation pipe to the top of the rotary.

Q. Would it make any difference if we carried the brake handle in release position? A. The only difference there would be is that the warning port is open to the atmosphere in release position, and this would cause a train pipe

leak.

Q. How could we arrange to double head with an engine equipped with the old style three way cock? A. Lap the three way cock and close the small plug cock in the gauge pipe.

Q. If cut-out cock is in No. 2 position and the pump fails to work, what will we do? A. Shut the steam off of the pump and go ahead.

Q. If the second engine has no cut-out cock, and the pump fails to work, what will we do? A. Put blind gasket in union of main reservoir pipe at brake valve.

Q. How would we carry the brake valve? A. In running position.

Q. Now what pressure seats the rotary valve? A. Train pipe pressure.

Q. How does train pipe pressure get to the top of the rotary valve? A. With the brake valve handle in running position, train pipe air can leak back up through the feed valve and reach the top of the rotary valve.

HANDLING TRAINS

G-6 Brake Valve With and Without Straight Air

Q. How would you make station stops? A. Would make a two application stop, if possible.

Q. Why is a two application stop better than a one application stop? A. With a two application, there is less danger of sliding wheels; can make a more accurate stop, and it overcomes the undesirable lurch of the train when the trucks are righting themselves.

Q. What do we mean by one application? A. From the time the brakes are applied until they are released regardless of the number of reductions used to apply them, is one application. To release and apply them again is the second application.

Q. In making a two-application stop, why do we lap the brake valve after releasing the first application? A. By lapping the brake valve, the train pipe is prevented from being

overcharged.

NOTE—On a passenger train carrying 110 lbs. train pipe pressure, for the first application we reduce the train pipe pressure to 95, possibly to 92 lbs. which is ample pressure to bring any train to a standstill. By lapping the brake valve only holds what pressure we have, and does not recharge the train pipe. By so doing, the brakes will respond and set quickly on the second application.

Q. What would you consider a safe reduction for the first application, the train moving at 50 or 60 miles per hour? A. A train traveling at high speed, a reduction of 15 to 18 lbs, would be safe for the first one.

Q. How low a speed would you bring the train to before releasing this application? A. That depends on the length of the train. With a short train, you may release at slow speed.

Q. Explain clearly how a two application passenger stop should be made? A. The first application should be made far enough away from the station that if allowed to remain it would stop the train before it would reach the desired point when the speed is reduced according to the length of the train; release the first application and bring the brake valve handle to lap position. Leave it there until the second application is desired, then begin by making a 5-lb. reduction, followed by light reduction of two to three lbs. each, until the train is stopped at the desired spot. With less than nine cars the brake should be released just as the train stops. With nine or more cars the brakes should be held applied until the train has come to a full stop.

Q. In handling freight trains, what would the first reduction be? A. From 5 to 7 pounds.

Q. In releasing the brakes on a long freight train, how long should the brake valve be left in release position? A.

The brake valve handle should be left in release position until the main reservoir and train pipe pointers on gauge register together and both rise above 70 depending on circumstances. Good judgment must be used.

Q. Why must we hold the brakes applied on a long train until it is brought to a standstill? A. On account of the slack in a long train.

Q. Should the straight air brake be used on releasing the brakes on a long train? A. Yes; the straight air brake should [illegible] before releasing the automat[illegible] It will keep the slack bunched and save drawheads and breaking trains.

Q. At what speed would it be safe to release the brakes on a 50-car train? A. If the engine be equipped with a straight air brake, not under 15 or 18 miles per hour.

Q. What speed would be safe to release at on a 25-car train? A. With straight air brake 6 to 8 miles per hour. Without the straight air brake, 12 miles per hour.

Q. If applying the brakes in full service and you found you was going to run past the mark, would you go to the emergency position? A. Yes, there may be some brakes partly leaked off on account of bad cylinders, or bad packing leathers. We may get more braking power out of them by going to the emergency position.

Q. How can we tell if the auxiliaries are charged? A. Lap the brake valve and watch if the train pipe pointer drops back. If it stops, the auxiliaries are charged to the figures it points to. But if it continues to drop back it denotes train pipe leaks.

Q. To make a 10-lb. reduction and lap the brake valve, and the train pipe exhaust continues to blow, where is the trouble? A. There is a leak in the equalizing pressure somewhere, or the equalizing discharge valve may be seated on dirt.

Q. If there is dirt on the seat of the equalizing discharge valve seat, how may it be dislodged? A. With a P.

R. R. cut-out cock, close the angle cock at rear of the tender; place brake valve in release position. With Westinghouse cut-out cock, close the cut-out cock instead of the angle cock as with the P. R. R. cut-out cock and place the brake valve handle in release position. This will cause the train pipe pressure to be built up quickly and lift the equalizing piston and blow the dirt from its seat.

Q. On applying the brakes, we get the proper blow from the preliminary exhaust, but the train pipe pointer on the gauge don't drop and get no blow at the train pipe exhaust. Where is the trouble? A. The body gasket may be leaking air into the equalizing pressure, or the packing ring on the equalizing piston may be leaking train pipe air up into Chamber D as fast as we can get it out through the preliminary exhaust port.

Q. If we could not get the equalizing piston to lift by reason of the preliminary exhaust port being stopped up, or for any other cause, how could we apply the brake? A. By going carefully to the emergency position.

Q. Are there any rules by which we may calculate the brake cylinder pressure by a given train pipe reduction? A. About the best rule to calculate from is 2½ to 1, with the proper piston travel, we say one pound reduction from the train pipe will develope 2½ lbs. in the brake cylinder. It is not claimed that this is a precise rule, but it is a quick calculation.

Q. Why will one pound reduction make 2½ lbs. in the brake cylinder? A. Because with the standard piston travel, the space in the brake cylinder is 2½ times smaller than the space in the auxiliary.

Q. Will the first 5 lbs. reduction give any braking power? A. No; it takes 5 lbs. to force the atmosphere pressure out of the brake cylinder compress the release spring, and drive the pistons out to bring the shoes up against the wheels.

Q. Will we proceed to calculate brake cylinder pressure

acording to train pipe reductions made? A. Yes.

Q. To attach to the brake cylinder a gauge, then make a 5-lb. reduction, would the gauge show any brake cylinder pressure? A. No.

Q. Why? A. The gauge is so constructed as to not register any pressure under atmosphere pressure.

Q. To make another 5-lb. reduction, what will the gauge register? A. 10x2½-25 lbs.

Q. Another 5-lb. reduction? A. 15x2½-37½ lbs.

Q. Another 5-lb reduction—20 lbs in all? A. 20x2½-50 lbs.

Q. When 50 lbs. per square inch is obtained in the brake cylinder, what do we call it? A. Equalization of pressures.

Q. Why? A. Because the auxiliary pressure has been reduced to 50 lbs. and the brake cylinder pressure has been built up to 50 lbs.

Q. How do all of the pressures stand with the brakes applied full? A.

Atmosphere	14 7-10
Main Reservoir	100
Equalizing Reservoir	50
Train Pipe	50
Auxiliary Reservoir	50
Brake Cylinder	50

Q. What are the rules in handling trains on descending grades? A. Must be handled by air brakes assisted by enough hand brakes to insure safe movement.

Q. Who is responsible for making tests on trains? A. The conductor, engineman and brakeman.

Q. After the brakes have been tested what must be done? A. Slack must not be taken up with the hand brakes, there is danger of shortening the piston travel too much and the piston would not clear the leakage groove and the brake could not be applied.

Q. How must the hand brakes be manipulated on a de-descending grade? A. So as to control the speed of the train when a full application of the air brakes will not be

required, thus leaving reserve power within the engineer's control.

Q. If, after starting down the grade the engineer discovers the hand brakes arranged for, is not sufficient, how can he make it known to the crew? A. Call for brakes.

Q. If a few more hand brakes prove to be unsufficient, then what? A. Call for brakes again.

Q. What should the flagman do? A. Gradually open the angle cock on the rear end of the rear car.

Q. Should the angle cock be closed after the reduction has been made? A. No, leave it open.

Q. What should the engineer do? A. Make a full application of the brakes; stop , and make safe arrangements to proceed.

Q. How would you leave a car standing on a siding? A. Secured by hand brakes.

Q. On descending a grade which hand should be used? A. Those working with the air and the brakes working against the air must not be touched if the engineer has called for brakes.

Q. How many retaining valves should be used descending a long grade of 2 per cent. A. All of them.

Q. Before starting to descend a long steep grade, what auxiliary pressure would you use to test the brakes? A. Not less than 95 lbs per sq. in.

Q. If after making a test at the top of a long steep grade you should be detained for a time, would you test the brakes again before you start? A. Yes, a road test.

Q. Why? A. To know for certain that the brake has not been tampered with and will respond when needed.

Q. Who arranges for the number of hand brakes to be used in addition to the power brakes, on descending long steep grades A. The engineer and the conductor.

Q. On descending long heavy grades of 2 per cent and over, where should the handle of the brake valve be carried? A. In release position.

Q. How should the engineer manipulate the brakes on such grades? A. So at to not reduce the train pipe pressure below 65 lbs.

Q. What is the running time on the eastern slope of the Allegheny mountains. A. 43 minutes. "AR" to "SF" 7 minutes, "SF" to "AG" 10 minutes; "AG" to "KN" 10 minutes, "KN" to "GY" 8 minutes; "GY" to "BO" 8 minutes.

Q. At the foot of a long steep grade, what must the engineer and the train crew do? A. When arriving at the foot of a hill and the engineer has the train under control so as to handle it safely with air brakes alone, he will whistle off brakes, the train men will then release all retaining valves and hand brakes beginning at the rear end, so as to keep the slack bunched until the brakes have all been released.

Q. After applying the brakes with a 20-lb. reduction, how would we release and put 20 lbs. in the brake cylinder? A. Place brake valve handle in release position until train pipe pointer raises to a few pounds above 70, then bring the handle to lap position. In 7 seconds from the time you went to release position, leave lap position and blow your train line pressure down about 4 lbs. below where you released at. For instance, you have a 70-lb. train pipe pressure. You blow down 20 lbs. to set the brakes, leaving 50 lbs. in train pipe. Now say we go to release position for two seconds—one second to go from release to lap, four seconds to stay on lap, then blow down to 46.

Q. Whyis this A. The feed port in the triple bush is of a size to feed one pound per second from a 70-lb. train pipe pressure. Allowing a little variation to consume seven seconds in releasing the auxiliary will recharge 5 lbs. Then by blowing the train pipe pressure down to where you released at, this will take the 5 lbs. out of the auxiliary and puts it in the brake cylinder. This brings the piston out and the shoes against the wheels. Then to reduce the train pipe pressure 4 lbs. more will give 20 lbs. brake cylinder pres-

sure.

Q. We make a 5-lb. reduction to bring the pistons out and shoes against the wheels. Then we want to put 10 lbs. in the brake cylinder. How much further reduction would we have to make? A. Two pounds.

Q. We make a 10-lb. reduction. How can we release and bring the pistons out, the shoes against the wheels and

Q. What is the size of the preliminary exhaust port? A. 5-64 of an inch in diameter.

Q. If this little port should become stopped up with dirt, could we apply the brake in service? A. Yes; by going very carefully into the emergency position.

Q. What kind of an application would we call this? A. Leaking the brakes on.

Q. If while running along, say, for 6 or 8 miles per hour and something should occur that you would want to make a quick stop, would you apply the brakes in the emergency? A. No; by applying the brakes in the emergency at low speed will slide the wheels, and sliding wheels will not hold. You will get better results by applying the brakes in service in this case.

Q. When coupled to a long train you apply the brakes and you notice the blow at the train pipe exhaust ceases about the time you lap the brake valve, what does it indicate? A. A very short train pipe. The angle cock on the rear of the tender may be closed.

Q. With a light engine to release the brakes, you get a blow at the train pipe exhaust. Why is this? A. The train pipe being short and placing the brake valve handle in release position charges the train pipe quicker than the equalizing reservoir. Hence the train pipe pressure lifts the equalizing piston, causing the blow.

Q. What does it depend on as to the length of time it requires to charge a 50-car train? A. It depends on the capacity of the main reservoir train pipe leakage and the condition and capacity of the pump.

AUTOMATIC SLACK ADJUSTER

Q. What is the slack adjuster for? A To retain a uniform piston travel.

Q. To what is it attached? A. To the pressure head of the brake cylinder and dead lever.

Q. What pressure operates it? A. Brake cylinder pressure.

Q. How is it operated by brake cylinder pressure? A. Pipe is atached to the brake cylinder at a point the piston reaches when uniform piston travel is attained which will be a little more than 8 inches from the pressurehead of the brake cylinder. The other end of the pipe is attached to the adjuster cylinder.

Q. What should be done with a car equipped with a slack adjuster? A. When new wheels are put in and new shoes put on, the slack should be taken up to a 6-inch piston travel by means of the dead lever and rod connections and not meddled with afterwards.

Q. How does the slack adjuster operate? A. As the shoes wear and rigging and trucks attain lost motion, the piston travel will become longer when the
a travel of 8 3-8 inches, the packing leather passes the port in the side of the brake cylinder and brake cylinder pressure passes through the connecting pipe to the adjustor cylinder, forces the adjuster piston back and seats the pawl in the second notch in the ratchet wheel. When the brakes are released the adjustor spring returns the adjustor to its normal position which turns the adjusting screw until the shoulder of the pawl strikes the jamb and unhooks.

Q. How much is the leverage shortened by each operation of the adjustor? A. About 1-32 of an inch.

MISCELLANEOUS—SPECIAL EXAMINATION

Questions on the Quick Action Brake.

Q. In making a terminal test, what should the inspector observe as he goes over the train? A. The inspector must

see that all angle cocks are open except the one on the rear of the last car in the train. Look for leaks and defects, and notice if each piston is out and how far on releasing. The inspector will go back over the train and see if all brakes have released properly, and notify the engineer personally of the number of cars in the train, number of brakes cut out, and how many brakes are in good working order.

Q. If you fail to have 85% of the brakes working, would you proceed with what you have? A. No.

Q. What is to be done in this case? A. The conductor will report the conditions to the Division Superintendent and be governed by his orders.

Q. Would you not recognize an order issued by the Yard Master? A. I would not recognize an order issued by any one except the superintendent.

Q. A passenger engine is disabled, cuts off and leaves the train. You couple to train with freight engine, then you will have a high speed brake on the train and a low speed brake on the engine. How would you arrange to leave with the least delay posible? A. Couple engine on to train; make a 10-lb. reduction; lap the brake valve and leave it it there; couple hose and open angle cocks. That is all you have to do. There will be a strong blow at the train pipe exhaust and a strong blow at the automatic reducing valve on each car. But let them blow; they will take care of themselves, and when the blows cease, release the brakes and go ahead.

Q. How long a time will it require to do this? A. After the engine is coupled to the train, from one to two minutes.

Q. Explain what causes the blow at the train pipe exhaust and at the reducing valve? A. The idea is to get rid of the high pressure in the train. After making a 10-lb. reduction leaving 60 lbs. in the train pipe on engine and tender, then to open the angle cock when the high pressure in the train will rush forward and lift the equalizing piston

and escape to the atmosphere through the train pipe exhaust, causing a strong blow when the angle cock is opened, the brakes on the train apply in the emergency. The high auxiliary pressure flows into the brake cylinder and compresses the spring of the reducing valve, and the brake cylinder pressure flows through the reducing valve, causing a blow there; so when the blow stops, you have 60 lbs. throughout the train pipe, 60 lbs. in the auxiliary and 60 lbs. in the brake cylinder, with 40 lbs. excess pressure in the main reservoir to release the brakes with .

Q. With the E-T equipment, what causes the blow at the straight exhaust when the brakes are applied from the train by opening an angle cock, or bursting a hose? A. When the brakes apply from the train, the brake valves are in running position. The reduction on the face of the equalizing piston in the distributing valve causes it to move the operative parts of the equalizing portion, and air is taken from the pressure chamber into the application chamber. Both brake valves being in running position it is free to flow from the application chamber to the atmosphere by way of release pipe, independent and automatic brake valve. Hence the blow occurs at the preliminary or straight exhaust of the automatic brake valve.

Q. Why is a feedpipe in a triple valve made so small? A. To cause a uniform recharge of the auxiliaries.

Q. Why not make the feed port larger? A. To make the feed port larger would be detrimental in three ways: First —If the feed port was too large, the front auxiliaries would be charged first, then while the auxiliaries on the rear end would be charging they would be drawing air from the one already charged, this would cause the brakes to creep on. Second—In making a service application of the brakes the auxiliary air would flow back into the train pipe and equalize, and with a light service reduction, say 7 or 8 lbs. the brakes with the large feed port would not apply at all, and those with small feed

ports that had applied would be released by the building up of the train pipe pressure from the auxiliaries attached to triples with large feed ports. Third—In releasing the brakes, the front end would release and the auxiliaries on the front end would be drawing air from the train pipe so fast that it would take considerable pumping to raise the pressure in the train pipe on the rear end of a long train sufficiently to force the piston to release position. The slack would out and a broken train would be the result.

Q. When testing brakes, can the engineer tell if the brakes set in quick action? A. Yes, by watching the train pipe pointer on the gauge. If it takes a dip and the train pipe exhaust ceases for an instant, the brakes have set in quick action.

Q. In handling long freight trains, what should the first reduction be? A. Owing to the numerous leaks in a long train pipe, it is necessary to use good judgment, but usually from 5 to 7 lbs. will be sufficient for the first reduction.

Q. Has the engineer on a passenger train any other way of telling if the brakes applied in quick action aside from the dipping of the gauge pointer, and the stoppage of train pipe exhaust? A. Yes; the reducing valve will blow.

Q. Having a train equipped with a high speed brake, and we stop along the way to pick up a car, that has neither reducing valve or safety valve, what must be done? A. It depends on the train we have. If we have less than nine cars, reduce the train pipe pressure from 110 to 70 lbs., and the main reservoir from 140 to 100 lbs., and use the brake on all of the cars. If we have nine cars or more, cut the brake out on the car not equipped for high speed brake and go ahead.

Q. What is the arrangement of the C. V. brake system? A. Two sets of brakes connected to the one set of rods.

Q. Where are such brakes used? A. On passenger cars only.

Q. If one of the brakes become defective would you cut

out the defective part or the whole brake? A. In this case where the two brakes are conected to the one set of rods, you would cut out the whole brake.

Q. Some passenger cars have two distinct brakes; one on each truck. If one becomes defective, would you cut out the whole brake? A. No; cut out the defective brake, and use the brake on the other truck.

Q. Is a train pipe leak always a reduction? A. No. It is not a reduction as long as it is supplied from the main reservoir.

Q. If we have the train pipe charged up, and make a reduction but the brakes do not apply, where is the trouble? A. The auxiliaries may not be charged.

Q. How can we tell if the auxiliaries are charged? A. Lap the brake valve if the train line pointer stands at 70 lbs. the auxiliaries are fully charged. If it drops below 70 the auxiliaries are not fully charged.

Q. How long does it take to charge an auxilliary on a freight car? A. If the standard train pipe pressure is maintained, it will require from one to two minutes.

Q. Time to charge a passenger coach using a carburator tank? A. Seven to ten minutes.

Q How long does it take to charge a large Pullman or Postal car using carburators and water raisers? A. From 20 to 21 minutes.

Q. Where does the carburator get its air from? A. The auxiliary reservoir.

Q. What pressure is carried in the carburator tank? A. 65 lbs. per square inch.

Q. Why is the pressure retained in the carburator tank? when the auxiliary pressure is reduced below 65 lbs.? A. On acount of being charged through a non-return check valve.

Q. Where does the water rising system get its air from? A. From the auxiliary reservoir.

Q How is it supplied? A. Through a reducing valve.

Q. What pressure is carried in the water raising tank? A. 20 lbs.

Q. If a brake becomes defective on a passenger car and has to be cut out, will the carburetor lights go out? A. In four hours they will go out.

Q. How can the triple valve be arranged to carry the cut-out cock in the branch pipe open, to charge the auxiliary keep the lights burning, supply the water raiser and keep the brake from applying? A. Block the triple piston in release position.

Q. How can this be done? A. By removing the stop plug; take out the graduating stem and spring; cut a piece of hard wood or iron long enough to hold the triple piston in release position and leave room to return the stop plug to its proper place.

Q. If the train pipe is fully charged, what do we do to get the brakes applied? A. Reduce the train pipe pressure.

Q. When the brakes are applied, what must be done to release them? A. Build up the train pipe pressure, or reduce the auxiliary reservoir pressure.

Q. How many ways have we to apply the brakes? A. Two; in service and emergency.

Q. What causes a service application of the brakes? A. A slow, gradual reduction in the train pipe pressure.

Q. If we take all of the air out of the train pipe by a slow, gradual reduction, how will the brakes apply? A. In service.

Q. While the reduction is going on, how long will the brakes continue to apply? A. Until equalization occurs between each individual auxiliary and train pipe pressure; according to the piston travel in each brake cylinder.

Q. What causese an emergency applicatron? A. A quick sudden reduction in the train pipe pressure.

Q. Is it necessary to take all of the air out of the train pipe to get the brakes to set in quick action? A. No.

Q. Why are we instructed that when an emergency ap-

plication of the brake is necessary we should place the brake valve handle in the emergency position and leave it there? A. This insures all brakes applying and remain applied.

Q. Why do we call a service application a uniform application? A. Because the brakes all apply at the same time.

Q. Is an emergency application a uniform application? A. No; one brake setting in the emergency starts the next one, and so on to the end of the train. If started by the brake valve, they follow each other to the rear end. If started at the rear end by opening an angle cock they follow each other to the front. If one triple goes to emergency position in the middle of the train, it starts the train on each side of it, and the brakes will set in the emergency from the middle and go both ways.

Q. In case a train breaks, what should be done? A. Close the throttle; place brake valve handle in emergency position, and protect all tracks until you know they are clear.

Q. While running along you feel the brakes gradually applying, and the train line pointer dropping back, what would you do? A. Lap the brake valve; stop and find out the trouble.

Q. If a bursted hose, how can you assist the train-crew to locate it, especially at night? A. Place the brake valve handle on the shoulder between running and lap positions with G-6 valve, with H-6 valve, between holding and lap position. This will cause a blow at the leaky hose, and still retain the main reservoir pressure.

Q. If a direct application of the brakes is made on the engine alone, and the brake valve is returned to lap position quickly, what causes the brakes to release? A. Chamber D. pressure has practically not been disturbed and is leaking past the equalizing piston packing ring which will build up the train pipe pressure sufficiently to force the triple piston to release position.

Q. What reductions will set the brakes full with the different piston travel? A. Less than 4-inch travel will not clear the leakage groove in the brake cylinder? A. 13½ lbs. reduction will set a 4-inch piston travel full. A. 17-lb. reduction will set a 6-inch travel full. A 20 lb. reduction will set an 8-inch travel full. A 25-lb. reduction will set a 9-inch travel full, but the 9-inch travel will only equalize at 45 lbs.

Q. With the system properly charged, how much pressure do we get in the brake cylinder from an emergency application? A. 60 lbs. per square inch.

Q. What per cent. of the 60 lbs. is taken from the train pipe? A. 1-6 or 10 lbs.

Q. When we get undesired quick action, we call it "a kicker;" what will cause a "kicker" when making a service application of the brake? A. Dirty, sticky triple valve. Possibly, having restricted ports assisted by train pipe leaks near the triple if on a short? A. A weak or broken graduating spring or stem will frequently cause the trouble.

Q. A triple that causes undesired quick action, or "kicker," is a source of trouble, and we want to cut that brake out if we can find it. How can we locate the triple that is causing the trouble? A. As a rule a triple will not cause undesired quick action back of the twentieth car unless assisted by train line leaks, so by stopping the leaks you will end the trouble. But we will corner the trouble in the first 20 cars. Close the angle cock; on the rear of the tenth car charge up and make a full service application of the brake. Watch the train line pointer closely to see if it takes a dip. If not found in the ten cars, cut in five more and apply the brakes again. If you still cannot locate the trouble, cut in two more cars, then if the kicker shows up, it is in either the 16th or 17th car cut out. Ctu out the 17th car and apply again. This time if the kicker shows up it is the 16th car. If it does not show up it is in the 17th car.

Q. With a long train have any way of telling if the kicker is on the front or rear end of the train? A. Yes; if it is on the front end the slack will bunch up and you will get a bump. If it occurs well back in the train, the slack will run out and you will get a jerk.

Q. When trying to locate a kicker, why not use light reduction? A. We may find a few brakes that would not apply from a light reduction on a long train on account of bad packing leather in the brake cylinder. It's not always the brake that does not apply on a long train that causes trouble. These brakes may apply from a heavy reduction.

Q. If you should find a brake that did not respond to a light reduction, would you cut it out? A. No.

Q. In coupling a low-speed engine to a high-speed train, why not lap the brake valve instead of making a 10-lb. reduction? A. By lapping the brake valve you would retain a 70-lb. pressure in the equalizing reservoir which would seat the equalizing discharge valve and hold the train pipe charged at 70 lbs. Then to release the brakes the train pipe would be overcharged and the brakes would creep on.

Q. In case while running along you get an overcharged train pipe, how would you get rid of the high pressure? A. Make a partial service application of the brakes heavy enough to reduce the train pipe pressure down to 60 lbs. This will bring the train to a standstill. Release and go ahead.

Q. What causes a blow at the triple exhaust while in release position? A. The emergency valve being unseated, the train line check valve gasket or the slide valve leaking.

Q. What pressure is leaking if the slide valve is leaking? A. Auxiliary reservoir pressure.

Q. What pressure is leaking if the check valve gasket or emergency valve is leaking? A. Train pipe pressure.

Q. How can we determine which defect is causing the blow? A. Close the cut-out cock in the branch pipe. If the

Q. If we could not get the equalizing piston to lift by reason of the preliminary exhaust port being stopped up, or for any other cause, how could we apply the brakes? A. By going carefully over the emergency position.

Q. Are there any rules by which we may calculate the brake cylinder pressure by a given train pipe reduction? A. About the best rule to calculate from is 2½ to 1, with the proper piston travel. We say one pound reduction from the train pipe will develope 2½ lbs. in the brake cylinder. It is not claimed that this is a precise rule, but it's a quick calculation.

Q. Why will one lb. reduction make 2½ lbs. in the brake cylinder? A. Because with the Standard piston travel the space in the brake cylinder is 2½ times smaller than the space in the auxiliary.

Q. Will the first 5 lbs. reduction give any braking power? A. No; it takes 5 lbs. to force the atmosphere pressure out of the brake cylinder compress, the release spring and drive the pistons out to bring the shoes up against the wheels.

Q. Will we proceed to calculate brake cylinder pressure according to train pipe reductions made? A. Yes, to attach to the brake cylinder a gauge, then make a 5-lb. reduction, would the gauge show any brake cylinder pressure? A. No.

Q. Why? A. The gauge is so constructed as to not register any pressure under atmosphere pressure.

Q. To make another 5-lb. reduction, what will the gauge register? A. 10x2½-25 lbs.

Q. Another 5-lb. reduction? A. 15x2½-37½ lbs.

Q. Another 5-lb. reduction, 20 lbs in all? A. 20x2½-50 lbs.

Q. When 50 lbs. per square inch is obtained in the brake cylinder what do we call it? A. Equalization of pressure. brake applies and the blow ceases it is a train pipe leak caused by the emergency valve or train line gasket. If the brake does not apply and the blow does not cease, the slide valve is leaking.

Q. Why? A. Because the auxiliary pressure has been reduced to 50 lbs. and the brake cylinder pressure has been built up to 50 lbs.

Q. How do all of the pressures stand with the brakes applied full. A.

Atmosphere	14 7-10
Main Reservoir	100
Equalizing Reservoir	50
Train Pipe	50
Auxiliary Reservoir	50
Boake Cylinder	50

Q. After applying the brakes with a 20-lb. reduction, how would we release and put 20 lbs. in the brake cylinder? A. Place brake valve handle in release position until train pipe pointer raises to a few pounds above 70, then bring handle to lap position. In seven seconds from the time you went to release position, leave lap position and blow your train line pressure down abut 4 lbs. blow where you released at, for instance, you have a 70-lb train pipe pressure, you blow down 20 lbs. to set the brakes, leaving 50 lbs. in train pipe. Now say we go to release position for two seconds; one second to go from release to lap; four seconds to stay on lap; then blow down to 46.

Q. Why is this? A. The feed port in the triple bush is of a size to feed one lb. per second from 70 lbs. train pipe pressure, allowing a litle variation to consume seven seconds in releasing the auxiliary will recharge 5 lbs., then by blowing the train pipe pressure down to where you released at, this will take the 5 lbs. out of the auxiliary and puts it in the brake cylinder. This brings the pistons out, and the shoe against the wheels. Then to reduce the train pipe pressure, 4 lbs. more will give 20 lbs. brake cylinder pressure.

Q. We make a 5 lb. reduction to bring the pistons out and shoes against the wheels. Then we want to put 10 lbs. in the brake cylinder. How much further reduction would we

have to make.? A. Two pounds.

Q. We make a 10 lb. reduction. How can we release and bring the pistons out, shoes against the wheels and have no braking power in the brake cylinder? A. Release as before, using the seven seconds in releasing; then blow the train pipe pressure down to where you released at.

Q. If in double heading with engines equipped with P. R. R. cut-out cock, you turn the cut-out cock on the second engine to No. 2 position and there is a strong blow at the axhaust port, what causes it and how can you remedy it? A. When this blow occurs, it is caused by a weak spring at the end of the cut-out cock and main reservoir pressure is leaking past the cut-out cock and escapes to the atmosphere. Cut a small wooden wedge and drive it down behind the handle of the cut-out cock and this will stop the blow.

Q. When the engine is standing alone with automatic brake valve handle in running position. You notice the brakes apply and release of their own accord. What is wrong with it? A. A gummy feed valve and train pipe leaks is what is causing it. Get the feed valve cleaned and stop the leaks is the remedy.

Q. What is the size of the train pipe exhaust port? A. 9-32 of an inch in diameter.

Q. Why is it made so small? A. To retard the flow of air from the train pipe to the atmosphere in making a service application of the brakes.

Q. Why not let the air out of the train pipe faster? A. By allowing the air to escape from the train pipe faster would cause too sudden a reduction and set the brakes in quick action.

Q. What is excess pressure and where is it carried? A. Excess pressure is the pressure in the main reservoir above that of the train pipe; for intance, we have 70 lbs. train pipe pressure, and 100 lbs. main reservoir pressure, then we have 30 lbs. above train pipe pressure, which is the

excess pressure, which in releasing will insure a more prompt release of the brakes.

Q. To what chamber of the distributing valve is the drain cock atached? A. To the application chamber.

Q. To couple up the application pipe and release pipe wrong at the distributing.

Q. How should the brakes be released on a long train? A. Place the brake valve handle in release position and leave it there until the train pipe and main reservoir pressure equalize, or until the train pipe pointer raises above 70, then bring valve handle to running position.

Q. To stop a train or car on a grade for an indefinite time, would you use the air or hand brakes to hold them? A. Hand brakes.

Q. How long could you rely on the air brakes holding a car standing on a grade? A. Eight minutes.

Q. What is automatic air brakes? A. A system operated by the variation of pressures? A. A reduction in the train pipe pressure will cause the brakes to apply. Building up of a train pipe will cause the brakes to release.

Q. What is straight air brakes? A. It is an engine brake receiving its air from the main reservoir. By building up the straight air pipe pressure applies the brakes. By releasing all of the pressure from the straight air pipe releases the brakes.

Q. What are the essential parts of an air brake on a car? A. Train pipe, cut-out cocks, hose, triple valve auxiliary reservoir, brake cylinder and retaining valve.

Q. Which will release first? A brake with a short or long piston travel? A. The long piston travel will start to release first, but will be last releasing.

Q. Why? A. Suppose we take a brake with an 8 inch piston travel and another with a 9 inch piston travel, and apply the brake with a full service application. We have 50 lbs in the 8 inch travel and about 38 lbs. in the 9 inch travel. To raise the train pipe pressure to release these

brakes, when the pressure is raised to 40 lbs. the 9 inch will start to release, but the train pipe must be raised to about 52 lbs. to start the 8 inch one to release position. The volume of air in the 9 inch travel is larger and will take longer to escape to the atmosphere, hence the long piston travel will be the slow one to release.

Q Referring to the safety of a locomotive, what is the first thing you look for when taking charge? A. Try the gauge cocks and glass water gauge; examine the crown sheet, sides and flue sheets.

Q. What is the first attention given to air? A. Drain, start, lubricate and test the pump, test the pressures, brake valve, feed valve and gauge.

Q. How many pressures do we use with a straight air brake? A. Two; main reservoir and brake cylinder pressure.

Q. Can the brakes be applied two ways from the train? A. Yes; open the angle cock slow and make a slow, gradual reduction and the brakes will apply in service. To open the angle cock quickly will cause a sudden reduction and the brakes will apply in the emergency.

Q. Should a 3-piston retaining valve be used on a light car with handle turned at an angle of 75%? A. No; it must be used in that position only on 100,000 capacity loaded cars.

Q. Where yard test plants are located, how would you make a test? A. Make a road test.

Q. What is the rule for making up freight trains? A. When the engine is coupled to the train, the engineer should lap the automatic brake valve until the train crew sees to it that all hose are coupled and all angle cocks are open, except the one on the rear end, and see that the cut-out cocks are all open. The auxiliary release valves are all closed and the handle on each retaining valve is turned down.

Q. When cutting off a train, what is the rule regarding the

safety of the train? A. All trains must be secured by hand brakes when left standing alone.

Q. When steadying a train around a curve, where should the brakes be applied and released? A. The brake should be applied on the straight line just before you strike the curve and released after the center of the curve is past.

Q. If while on the road the brakes should fail entirely, how would you proceed? A. Arrange to have the train controlled by hand brakes to the first telegraph or telephone office, report the condition to the Superintendent and be governed by his orders.

Q. If a leak is found at hose coupling gasket, how can it be remedied? A. Renew the gasket. If you do not have a gasket, drive a wooden wedge between the knuckle and lug. This will usually stop the leak.

Q. Where train men take hose from an engine to replace on cars, what should they do? A. Return the defective hose so as the engineer may turn in and get proper credit for same.

Q. To open a car discharge valve, and no air escapes, but air will escape from the discharge valve on the car ahead, and the car behind it, what may be wrong? A. There may be a blind gasket inserted or the strainer may be entirely closed with dirt.

Q. In making up trains, all hose are coupled. How should the angle cock be opened on turning in the air from the engine? A. Slow; to prevent quick action on the tender.

Q. Why is a 12-inch piston not a good one? A. Because the piston will come out against the non-pressure head of the brake cylinder, and the shoes will not touch the wheels.

Q. Should air hose be pulled apart? A. No; uncouple them by hand, by pulling them apart.

Q. What damage would it do to pull them apart? A. It sprains the hose, causing them to burst near the pipe connection. It also breaks the angle cock off at the train pipe sleeve.

Q When applying new pipes or hose, and in many cases coupling, what should be done? A. Blow them out to rid them of sand, scale and dust.

Q. Is there anything about the automatic brake valve that will cause the loss of excess pressure? A. Yes; if the regulating valve of the feed valve sticks open, a leaky supply valve of the feed valve, a leaky rotary valve or a cracked feed valve gasket, any of these defects will cause loss of excess pressure.

Q. On a freight car having two brake staffs, which one works with the air? A. The one on the end of the car where the retaining valve is located.

Q. Why should all of the air hose be coupled up before turning on the air? A. To cause a uniform charging of the auxiliaries. By turning air into a part of the train those auxiliaries will be charged, then turn in more care. The brakes with the charge auxiliary will apply and is a waste of air.

Q. In making up freight trains, how many brakes in consecutive order should be cut out? A. Not more than two.

Q. Why not more than two? A. If more than two brakes are cut out and the brakes are applied in the emergency, the brakes ahead of the cut-out brakes will apply in the emergency, but the reduction will not be sudden enough to cause quick action back of the cut-out cars.

Q. What is the object of the P. R. R. cut-out cock? A. To allow the second engine to be cut out. The front engineer having full control of the brakes and giving the second engineer an opportunity to read the gauge and know what train pipe reductions are being made, and if the engineer on the second engine sees danger ahead, he can apply the brakes in the emergency, but not in service. Neither can he release the brakes with the cut-out cock in No. 2 position.

Q. Can you locate a leaky pin-valve in pump governor? A. By a constant flow of air through release Port C. while

the pump is working.

Q. Place the brake valve handle in running position, but no air enters the train pipe, where would the trouble be? A. The regulating valve in the feed valve is gummed up.

55. Q. If the gauge pipe leading to the train pipe pointer was broken off how could you handle the brakes? A. Put blind gasket in union of equalized reservoir T carry brake valve handle in release position and apply the brakes by leaking them on or by going carefully into the emergency position.

Q. Do you have a gauge to guide you in this kind of braking? A. No; this is called braking by sound.

Q. In a service application with the E. T. equipment, is the cylinder pressure on engine and tender uniform with the pressures in the train brake cylinders? A. Yes; just as uniform as with the standard quick action.

Q. With an emergency application of a high speed brake, what pressure do we get in the driver brake cylinders? A. 68 lbs.

Q. With the E. T. we make a light service application, and the brake cylinder pressure continues to increase, what is causing it? A. A leaky rotary valve in the independent brake valve, leaky equalizing slide valve, or a leak past the gasket.

Q. With the same kind of an application and the brake cylinder pressure decreases what is causing it? A. A leaky brake cylinder or bad piston packing leather or leaky exhaust valve.

Q How can we tell if the application valve is leaking, or if it is the exhaust valve leaking? A. If the application valve is leaking, the brake cylinder pressure will raise as will be indicated by the red hand on the small gauge. If the exhaust valve is leaking, there will be a blow at the distributing valve exhaust.

Q. When freight trainmen are ready to test brakes, how will they signal the engineer to apply the brakes? A. By displaying hand-lamp or flag, held at arm's length above the

head. To release the brakes the same signals will be used horizontally above the head.

Q How will passenger train men signal the engineer to apply the brakes? A. By pulling cord four times from the rear platform of the rear car. To get the engineer to release the brakes, they will pull the cord another four times.

Q. If the inspector or trainmen find a car in their train with the brake cut out and not carded, and can't see any defect, what should they do with it? A. Cut it in and test it. The brake may be all right; if found defective, cut it out and properly card it.

Q. How should a Conductor's emergency valve be opened to stop a train? A. Open it wide, and hold it open until the train is stopped.

Q. Can the conductor make a service stop with the emergency valve? A. Yes; by gradually opening the emergency valve.

Q. Should the angle cock be used to stop trains? A. Only in case of emergency.

Q What pasenger cars have two sets of brakes with a branch pipe to each tripple valve? A. Heavy steel Pullman cars.

Q. Would you cut out one or both brakes if one should fail? A. Cut out the defective one and use the other.

Q. If the train pipe check valve is leaking, what effect will it have when the brake is applied? A. It will release that brake.

Q. What effect will a leaky graduating valve have? A. With the triple in service lap position, it will cause the brake to apply harder. It can do no harm in either release service or emergency position.

Q. What is the purpose of the air signal system? A. For the conductor to communicate to the engineer.

Q. What is the size of the preliminary exhaust port? A. 5-64 of an inch in diameter.

Q. If this little port should become stopped up with

dirt, could we apply the brake in service? A. Yes; by going very carefully into the emergency position.

Q. What kind of an application would you call this? A. Leaking the brakes on.

Q. If while running along, say, six or eight miles per hour and something should occur that you would want to make a quick stop, would you apply the brakes in the emergency? A. No; by applying the brakes in the emergency at low speed will slide the wheels, and sliding wheels will not hold. You will get better results by applying the brakes in service in this case.

Q. When coupled to a long train you apply the brakes and you notice the blow at the train pipe exhaust ceases about the time you lap the brake valve, what does it indicate? A. A very short train pipe. The angle cock on the rear of the tender may be closed.

Q. With a light engine to release the brakes, you get a blow at the train pipe exhaust; why is this? A. The train pipe being short and placing the brake valve handle in release position charges the train pipe quicker than the equalizing reservoir, hence the train pipe pressure lifts the equalizing piston, causing the blow.

Q. What does it depend on as to the length of time it requires to charge a 50-car train? A. It depends on the capacity of the main reservoir, train pipe leakage and the condition and capacity of the pump.

AUTOMATIC SLACK ADJUSTER.

Q. What is the slack adjuster for? A To retain a uniform piston travel.

Q. To what is it attached- A. To the pressure head of the brake cylinder and dead lever.

Q. What pressure operates it? A. Brake cylinder pressure

Q. How is it operated by brake cylinder pressure? A. A pipe is attached to the brake cylinder at a point the piston reaches when uniform piston travel is attained, which

will be a little more than 8 inches from the pressure-head of the brake cylinder. The other end of the pipe is attached to the adjuster cylinder.

Q What should be done with a car equipped with a slack adjuster? A. When new wheels are put in and new shoes put on the slack should be taken up to a 6-inch piston travel by means of the dead lever and rod connections and not meddled with afterward.

Q. How does the slack adjuster operate? A. As the shoes wear and rigging and trucks attain lost motion the piston travel will become longer when the piston reaches a travel of 8⅜ inches. The packing leather passes the port inside of the brake cylinder, the brake cylinder pressure passes through the connecting pipe to the adjuster cylinder, forces the adjuster piston back and seats the in the second notch in the rachet-wheel. When the brakes are released the adjuster spring returns the adjuster to its normal position which turns the adjusting screw until the shoulder of the (?????)**** strikes the jamb and hooks.

Q. How much is the leverage shortened by each operation of the adjuster? A. About 1-?? of an inch.

BRAKE CYLINDERS.

Q. What size brake cylinders are used on cars? A. 6, 8, 10, 12, 14 and 16 inches in diameter.

Q. Where are brake cylinders located on cars? A. At the most convenient place where repairs may be easily made.

Q. What are the operative parts of the brake cylinder? A. Piston, packing leather, expander ring and release spring.

Q. What is the duty of the release spring? A. To return the piston to release position when the pressure has been exhausted from the cylinder.

Q. What is the duty of the packing leather? A. To make an air-tight joint around the piston.

Q. What is the duty of the expander ring? A. Its duty

is to hold the packing leather snugly against the walls of the cylinder.

Q. Are there any ports or grooves in a brake cylinder? A. Yes, there is one port leading to the slack adjuster when it is attached; there is also a groove in the wall of the cylinder in the end next to the pressure head.

Q. What is the name of this groove? A. Leakage groove.

Q. Why is the leakage groove in a brake cylinder? A. Train pipe leaks may cause a sensitve triple to admit a little air into the brake cylinder, a leaky gasket or a leaky auxiliary tube may admit a small amount of air into the brake cylinder. In cases of such light leaks of air into the brake cylinder it will pass by the piston to the atmosphere and not cause the brake to drag.

Q. Brake cylinders are not of the same width; are they of the same length? A. No, they are made to meet the different requirements.

Q. How are brake cylinders attached to cars? A. By means of rods or braces attached to the car sills.

Q. From what is the size of a brake cylinder to be used on a car, calculated? A. From the total weight of the car.

Q. How are brake cylinders and auxiliary reservoirs arranged on a freight car? A. Connected together.

Q. What style or type would you call it? A. Combined type.

Q. Is the triple valve attached to the brake cylinder? A. No, the triple is attached to the auxiliary reservoir.

Q. How does the air get from the tripple valve past the auxiliary to the brake cylinder? A. While the auxiliary is between the triple valve and brake cylinder. There is a tube that runs lengthwise through the auxiliary and the air passes from the auxiliary through the triple valve and through the auxiliary tube into the brake cylinder.

Q. When and how does the air get out of the brake cylinder? A. It passes through the auxiliary tube to the underside of the triple slide valve and to the atmosphere.

Q. How is the brake cylinder and auxiliary located on a passenger car? A. Usually one on each side.

Q. Is the triple valve attached to the auxiliary reservoir on a passenger car? A. No, a brake cylinder on a passenget car has a different designed pressure head and the triple valve is attached to this brake cylinder head.

Q. How does the air get into the auxiliary and brake cylinder, one being on each side under a car? A. The triple and auxiliary are connected by a pipe.

Q. Explain how the air passes through a passenger equipment in applying and releasing the brakes. A. With triple in release position, air passes from the train pipe past the triple piston and through the connecting pipe into the auxiliary, in applying the brakes air passes from the auxiliary back through the connecting pipe through the triple valve into the brake cylinder, in releasing the brake air passes from the brake cylinder through the triple to the atmosphere.

Q. When a brake releases and there is no exhaust at the triple we say the brake dropped off. What is the cause of it? A. Sometimes the air is leaking past the pressure head, but usually the packing leather is in bad condition, it being hard and dry and not forming an air-tight joint against the walls of the cylinder. If the expander ring is not in proper place air will escape past the packing leather and the brake will drop off.

Q. Does the expander ring ever cause any other trouble? A. Yes, if it is out of place it may bind the piston against the walls of the cylinder and prevent the release spring from returning to release position and not give the brake shoes the proper clearance.

Q. How long is the leakage groove in a brake cylinder? A. About 3¼ inches.

Q. If the leakage groove was closed with dirt or gum, what effect would it have? A. Any leakage into the brake cylinder could not escape past the piston and would cause

the brakes to drag.

Q. If the release spring was broken, would there be any bad effect? A. In releasing the brakes the piston would not be returned to release position promptly.

AUXILIARY RESERVOIRS.

Q. What are auxiliary reservoirs used for? A. To carry in store air for each individual brake.

Q. As the size of the brake cylinder is calculated by the weight of the car, how are we to be governed as to what size reservoir to use? A. The brake cylinder is calculated by the weight of the car and the auxiliary is governed by the size of the brake cylinder used.

Q. How would you bleed the auxiliary reservoir? A. Open the bleed cock and hold it open until the air is out of the auxiliary.

Q. If a brake was stuck and you wanted to release it, how would you do? A. Open the bleed cock until the brake started to release, then close it.

Q. Why not hold it open longer? A. By holding it open longer would only be a waste of air.

Q. What size reservoirs are used on freight cars? A. For 6, 8 and 10-inch brake cylinders used in freight service the various cast iron standard reservoirs are used. If a passenger or tender is equipped with an 8-inch cylinder it would require an auxiliary 10x24 inches. Auxiliaries attached to driver brakes are 10x33 inches. If 10-inch cylinders are used on an engine tender or passenger car a 12x33-inch auxiliary is necessary. Where a 12-inch cylinder is used an auxiliary 14x33 inches is used; 14-inch cylinder, 16x 33-inch auxiliary is used, and a 16-inch cylinder a 16x42-inch auxiliary is used.

TEST PUMP GOVERNOR.

Pump pressure up fully, make an application of 10 or 15 pounds, release and note if governor stops pump when the desired pressure is gained.

TEST FEED VALVE.

Make a full service reduction, release and when the black hand registers with red hand place brake valve in running position and see if black hand stops at train line pressure required.

TEST BRAKE VALVE.

Pump up to pressure make a reduction of 20 pounds. The preliminary exhaust port in rotary seat is a plugged of 5-64 of an inch in diameter and should reduce Chamber D pressure 20 pounds in six seconds; listen to the blow at the preliminary exhaust; if the blow is weak and the train line drops to slow, Port E may be gummed up; if the blow is trong and the train line hand drops to slow the body gasket or the packing rings in the equalizing discharge valve may be leaking. With the brake valve on lap both hands raise to 100 there may be a leaky gasket between the brake valve and the feed valve.

TEST SIGNAL LINE.

Open and close plub cock on signal line at rear of tender to see if reducting valve is open and see if signal valve will respond; if so, the whistle will sound.

CLEANING TRIPLE VALVES.

Q. Explain the proper way to clean a triple valve. A. Unbolt the triple, remove all operative parts, clean each part thoroughly, using a cloth that has no lint; clean all ports and feed groove, using a bit of wood to remove the gum from the feed groove; soak the piston in kerosene, then work the piston packing ring until it is loose and sensitive, but do not remove the ring from the piston; take a drop of oil on the tip of the finger and oil the piston packing ring and the face of the slide valve; the other parts do not need any oil. Return all parts to their proper places. The train line check valve case gasket has one fluted side; this side goes down. The triple should then be placed on a testing rack for a test.

CLEANING BRAKE CYLINDERS.

Q. How often should a brake cylinder be cleaned? A. Once in six months.

Q. What is the proper method of cleaning a brake cylinder? A. Remove the non-pressure cylinder head and piston, remove the follower plate expander ring and packing leather, wipe each part perfectly clean, warm the packing leather and work it with the hands until it is perfectly soft and pliable, return it to its proper place on the piston, then insert the expander ring; notice that it is a perfect ring and fits snugly; then bolt on the follower plate. The walls of the cylinder must be perfectly cleaned, and care must be taken that the leakage groove is rid of all gum and dirt. Do not use a steel instrument to clean the leakage groove; use a piece of wood; this will prevent wearing the groove larger. When all parts have been examined and cleaned take grease on the hand and rub the walls of the brake cylinder. Then return the piston, using care that the packing leather is not cramped, but must be held against the walls of the cylinder by the expander ring to make an air-tight joint; then replace the release spring and non-pressure head.

Q. After a cylinder is cleaned and oiled, what is yet to do? A. Stencil on the outside with paint the day, month and year that it was cleaned and oiled.

E. T. NO. 6 EQUIPMENT

Q. Why is this equipment called the E. T.? A. Because it applies to engines and tenders only.

Q. Does the E. T. brake work in harmony with all other brakes on a train? A. Yes, the E. T. equipment does work in harmony with all other brakes.

Q. What are the features claimed for the E. T. over the quick-action brake? A. With the E. T. equipment the brakes may be released on the train and held on the engine, or released on the engine and held on the train and re-applied on the engine.

Q. What are the essential part of the E. T. equipment? A. Air pumps, main reservoir, pump governor, two brake valves, two duplex gauges, distributing valve, brake cylinder cut-out cocks, pipes and hose connections, feed valve, reducing valve and equalizing reservoir.

Q. Can you explain the essential parts of the E. T.? A. The standard 9½-inch air pump as explained in the quick-action brake is used, also the same main reservoirs are used with the E. T., as with the quick-action brake.

Q. What is the capacity of the main reservoir? A. 40,000 cubic inches for the passenger reservoir service; 60,000 cubic inches for freight service.

Q. Can you name the pipes of the E. T.? A. Exhaust pipe, connecting pipe, main reservoir pipe, train pipe, brake cylinder pipe, by-pass pipe, feed valve pipe, reducing valve pipe, signal pipe, application pipe, release pipe, release connecting pipe, three governor pipes, four gauge pipes and equalizing reservoir pipe.

Q. Can you give the extension of each pipe, with the number of pounds per square inch they contain? A. I—Exhaust pipe extends from the pump to the main reservoir, contains 100 lbs.

2—Connecting pipe extends from one main reservoir to the other, contains 100 lbs.

3—Main reservoir pipe extends from main reservoir to the automatic brake valve, branching to the distributing valve, feed valve and reducing valve, contains 100 lbs.

4—Train pipe extends length of engine and tender, branches to the automatic brake valve and distributing valve, contains 70 lbs.

5—Brake cylinder pipe extends from the distributing valve to the driver, tender and engine truck brake cylinders and contains brake cylinder pressure equalization, 50 lbs.

6—The by-pass pipe extends from the train pipe to the main reservoir pipe; this being the dead engine pipe it contains 100 lbs. at one side of the cut-out cock and 70 lbs. at

the other.

7—The feed valve pipe extends from the feed valve to the automatic brake valve, contains 70 lbs.

8—The reducing valve pipe extends from the reducing valve to the independent brake valve, contains 45 lbs.

9—The application pipe extends from the distributing valve to the independent brake valve, also branches to the automatic brake valve; with a full independent application of the brake this pipe contains 45 lbs.; with a full automatic service 50 lbs.; with an emergency application 88 lbs.

10—The release pipe extends from the distributing valve to the independent brake valve.

11—Also the connecting release pipe which connects the two brake valves is used in connection with the release pipe and contains the same pressure as the application cylinder, according to the application made.

12—The qualizing reservoir pipe extends from the "T" at the automatic brake valve to the equalizing reservoir, contains 70 lbs.

13—A 3-16 copper pipe extends from the main reservoir pipe to the maximum governor head below the diaphragm, contains 100 lbs.

14—The excess governor has two pipes connected, one extending from the automatic brake valve to the excess governor head under the diaphragm, contains 100 lbs.

15—The other pipe extends from the feed valve pipe to the excess governor above the diaphragm, contains 70 lbs.

16—The signal pipe extends from the reducing valve pipe, contains 45 lbs.

CUT-OUT COCKS.

Q. How many cut-out cocks are used in the E. T. equipment? A. Eight in freight, nine in passenger service.

Q. On what pipes are they located? A. On the main reservoir pipe, on branch pipe from train pipe under the automatic brake valve, on branch of main reservoir pipe leading to the distributing valve, on brake cylinder pipe

near driver brake, engine truck and tender brake cylinder, one on each end of train pipe and one on the by-pass pipe.

NOTE—Where the Westinghouse cut-out cock is used it is located in the train pipe just under the automatic brake valve; but where the P. R. R. cut-out cock is used it is located on the main reservoir pipe just under the automatic brake valve.

Q. Are the cut-out cocks of the same model? A. No, the one at the rear of the tender is an angle cock.

Q. How should the handle of the angle cock be when closed? A. Lengthwise of the pipe.

Q. Are the angle cocks all of the same style? A. There are two kinds; one the old style, the other has an improved handle which has to be raised before it can be turned; it's a lock handle.

Q. How is the handle of an angle cock to be when open? A. Lengthwise of the pipe.

Q. If the handle was lost off, how can we tell if it is open or shut? A. By the port mark in the top of the key, which must be in line with the pipe to be open.

Q. Do we ever find a plug cut-out cock in a car? A. We sometimes find a plug cock on the train pipe of foreign passenger cars, and in case we do the handle must be crosswise of the pipe to be open, just opposite to angle cock.

Q. What kind of a cock is on the front end of train pipe on an engine? A. A straight plug cock.

SIAMESE DUPLEX PUMP GOVERNOR.

Q. What is a duplex pump governor? A. Two governor heads attached to one steam fitting.

Q. Are the two governor heads alike? A. Yes, each having the same operative parts.

Q. What are the names of these heads? A. The maximum and the excess pressure heads.

Q. Which of the heads control the pumps? A. The ex-

cess pressure head.

Q. If for any reason the excess pressure head should fail, would the maximum pressure head control the pumps? A. Yes.

Q. What presure is connected to the maximum governor head? A. Main reservoir pressure.

Q. What pressures are connected to the excess governor head? A. Main reservoir pressure under the diaphragm and feed pipe pressure above the diaphragm.

NOTE—While the two governor heads have the same operative parts as explained in the quick-action governor, the two heads being attached to the steam end by a "T."

Q. What should be done with release Port "C" when the duplex governor is used? A. Each governor head having a Port "C" one should be plugged.

Q. Why is the duplex governor used? A. To control the pump with two pressures.

Q. In what service is the duplex governor used? A. In passenger service only.

Q. Why plug one release port? A. By letting both ports open would cause an unnecessary waste of air from the main reservoir when either of the heads stopped the pump.

DISTRIBUTING VALVE.

Q. What is the mechanical idea of a distributing valve? A. Two triple valves.

Q. To what is it attached? A. A divided reservoir.

Q. Where is it usually located? A. Under the cab on the right side.

Q. How many pipes are connected to the distributing valve? A. Five.

Q. Name the pipes that are connected to the distributing valve, and tell where they are connected. A. 1—The supply pipe, a branch pipe from the main reservoir pipe, the top connection on the left side.

2—Application pipe from independent and automatic brake valves, connection at the left side of the distributing valve.

3—Release pipe from the independent brake valve, the lower connection on the left side of the distributing valve.

4—A branch pipe from the train pipe is attached to the lower connection on the right side of the distributing valve.

5—The brake cylinder pipe is attached to the top connection on the right side of the distributing valve.

Q. Is there anything else attached to the distributing valve? A. Yes, a safety valve.

Q. What pressure is the safety valve set at? A. 68 lbs.

Q. What does the divided reservoir and distributing valve take the place of? A. The triple valves, auxiliary reservoirs, and in the high-speed brake, the automatic reducing valve.

Q. How many positions has the distributing valve? A. Eight.

Q. Name them. A. 1, release; 2, service; 3, service lap; 4, emergency; 5, emergency lap; 6, independent release; 7, independent application; 8, independent lap.

Q. What are the names of the two chambers in the divided reservoir? A. Pressure and application chambers.

Q. What pressure does these chambers represent? A. Auxiliary reservoir and brake cylinder pressure.

Q. How are they proportioned? A. The pressure chamber is proportioned with the auxiliary reservoir and the application chamber with the brake cylinder.

Q. The distributing valve is divided into how many portions? A. Two.

Q. What are they? A. The equalizing and application portion.

Q. How many operative parts has the equalizing portion? A. Three.

Q. Name them. A. Equalizing piston, graduating valve and slide valve.

Q. And resembles very closely what? A. The operative parts of a "K" triple valve.

Q. How many operative parts has the application portion? A. Three.

Q. Name them. A. Application piston, application valve and exhaust valve.

Q. Some roads use another part to the distributing valve, what is it? A. An emergency cap.

Q. To what part is the emergency cap attached? A. To the train pipe end of the equalizing portion.

Q. How many parts has the emergency cap? A. Three.

Q. Name them. A. Piston, slide valve and emergency valve-graduating stem and spring.

Q. The application piston works in a small cylinder. What cylinder would you call it? A. Application cylinder.

Q. Is the application cylinder connected to any other chamber? A. Yes; it is connected with the application chamber at all times.

Q. Why is this so? A. To increase the volume of the application cylinder.

Q. Of the eight positions of the distributing valve, in how many positions does the application cylinder pressure register with the safety valve? A. Seven.

Q. In what position does it not register? A. In service lap position.

Q. How does the air get into the pressure chamber? A. Train pipe air passes equalizing piston (in release position) by way of small groove in the bush, the same as in a triple valve.

Q. Explain the operation of the distributing valve in a service application of the brakes? A. The train pipe pressure being reduced, the equalizing piston responds and follows the weaker pressure. In doing so it closes the feed groove in the bush, moves the graduating valve and brings the slide valve to service position, opening communication between the pressure chamber and the application chamber

and the air from the pressure chamber flows through Port "Z" in the slide valve into the application chamber and cylinder, until equalization occurs between the train pipe and pressure chamber pressures; when the equalizing piston will move back, also moving the graduating valve back to close Port "Z," this being service lap position of the equalizing portion. The air that comes into the application chamber flows direct into the application cylinder, moves the application piston to application position, which forces the exhaust valve back, closing communication between the brake cylinder and the atmosphere and opening the application valve which allows main reservoir pressure to flow into the brake cylinder until the brake cylinder pressure equals that of the application cylinder, when the application portion will go to independent lap position and brakes are applied.

Q. Explain the operation of the distributing valve to release the brakes. A. Both portions of the distributing valve being on lap, the train pipe being recharged forces the equalizing piston to release position. At this time both brake valves in running position, the application cylinder pressure is exhausted to the atmosphere by way of the independent and automatic brake valve, the application piston going to release position the brake cylinder pressure is exhausted to the atmosphere through the distributing valve exhaust and the brakes are released.

PRESSURES.

Q. How many pressures are used with the E. T. equipment? A. Nine.

Q. Name them, giving pressure per square inch of each.
A. 1—Atmospheric pressure 14 7-10 lbs.

2—Main reservoir pressure 100 lbs.

3—Train line pressure 70 lbs.

4—Feed valve pipe pressure 70 lbs.

5—Reducing valve pipe pressure 45 lbs.

6—Equalizing reservoir pipe pressure 70 lbs.

7—Brake cylinder pipe pressure in full service with the proper piston travel 50 lbs.

8—In the emergency 88 lbs.

9—Application chamber 2½ times the train pipe reduction or full service 50 lbs.

AUTOMATIC BRAKE VALVE.

Q. What brake valve is this? A. The H-6.

Q. How many valves has it? A. Two.

Q Name them. A. Rotary and equalizing discharge valve.

Q. How many positions has it? A. Six.

Q. Name them. A. Release, running, holding, lap, service and emergency.

Q. Is the feed valve attached to the brake valve? A. No; the feed valve is attached to a branch pipe from the main reservoir pipe.

Q. In release position the air passes from where to where? A. From the main reservoir to the train pipe; from the main reservoir to the equalizing reservoir; from the main reservoir to the excess governor top below the diaphragm; from the feed valve pipe to the atmosphere by way of the warning port.

Q. In running position the air passes from where to where? A. From the feed valve pipe to the train pipe; from the train pipe to the equalizing reservoir; from the main reservoir to the excess governor top below the diaphragm and from the application cylinder of the distributing valve to the atmosphere by way of independent and automatic brake valves.

Q. In holding position air passes from where to where? A. From the feed valve pipe to the train pipe; from the train pipe to the equalizing reservoir, and from the main reservoir to the excess governor top below the diaphragm.

Q. In lap position the air passes from where to where? A. All ports closed.

Q. In service position air passes from where to where?

A. From the equalizing reservoir to the atmosphere by way of preliminary exhaust port and straight exhaust, and from the train pipe to the atmosphere by way of train pipe exhaust.

Q. In the emergency position air passes from where to where. A. From the train pipe direct to the atmosphere and from the main reservoir to the application cylinder by way of blow-down retarding port.

Q. How many pipes are connected to the automatic brake valve? A. Seven.

Q. What pipes are they? A. 1, main reservoir pipe; 2, train pipe; 3, feed valve pipe; 4, "T" pipe to equalizing reservoir; 5, pipe to excess governor top; 6, a branch of the application pipe; 7, the connecting release pipe.

INDEPENDENT BRAKE VALVE.

Q. What is the name of this valve? A. S-6.

Q. How many valves are there in the independent brake valve? A. One.

Q. What is its name? A. The independent rotary.

Q. How many positions has the rotary valve? A. Five.

Q. Name them. A. 1, release; 2, running; 3, lap; 4, slow service; 5, quick service.

Q. What pressure seats the independent rotary valve? A. Reducing valve pressure.

Q. How many pipes are connected to the independent brake valve? A. Four.

Q. Name them. A. 1, reducing valve pipe; 2, application pipe; 3, release pipe; 4, connecting release pipe.

Q. Air passes from where to where through the independent brake valve? A. 1—In release position air passes from the application chamber to the atmosphere and from the reducing valve pressure to the atmosphere by way of the warning port.

2—In running position air passes from the application chamber to the atmosphere by way of independent and automatic brake valves.

3—In lap position all ports are blank.

4—In slow service air passes from the top of the rotary valve through a small groove to the application pipe.

5—In quick service position air passes from the top of the rotary through a large port to the application pipe.

Q. Why is a spring used with this brake valve? A. To return the handle from release to running position and from quick service to slow service position.

Q. Why not let the brake valve handle in release position? A. By doing so the engine brakes could not be released automatically.

Q. Should this spring break and the break valve handle remain in release position, what would call the engineer's attention to this? A. The warning port would call his attention to this.

GAUGES.

Q. What pressures do the gauge pointers indicate? A. 1—The red hand on the large gauge, the main reservoir pressure.

2—The black hand on the large gauge, equalizing reservoir pressure.

3—The black hand on the small gauge train pipe pressure.

4—The red hand on the small gauge brake cylinder pressure.

NON-RETURN CHECK VALVES.

Q. How many non-return checks are used? A. One in freight and two in passenger service.

Q. Where are they located? A. In the signal pipe and in the by-pass pipe.

Q. How are these checks held to their seats? A. By a spring.

Q. What tension has the spring on the by-pass pipe? A. 20 lbs.

Q. Why is this check located here? A. When using the dead engine feature it prevents main reservoir air from entering the train pipe while applying the brake.

Q. Why is a non-return check used in the signal pipe? A. Without it the signal whistle would sound every time the independent brake valve was applied.

Q. What tension has this check valve? A. From two to three lbs.

FEED VALVE.

Q. Is there any difference in the feed valve and the reducing valve? A. They are practically the same, except that the feed valve has a thumb wheel by which to raise and lower the train pipe pressure quickly.

CHOKE FITTINGS.

Q. How many choke fittings are used? A. One in freight and two in passenger service.

Q. Where are they located? A. In the back end of brake pipe at hose connection; in passenger service the other is in the front end at end of brake pipe, where hose to engine truck is connected.

Q. Why are they used? A. If either the hose between tank and engine or engine truck hose should burst, the choke fiting would retard the flow of air.

Q. What is the diameter of the port through the choke plug? A. 5-16 of an inch.

BROKEN PIPES.

Q. If the supply pipe should break off at the distributing valve, what would you do? A. Close the cut-out cock on the supply pipe, blank the branch pipe between the train pipe and the distributing valve.

Q. Would this disable the brake? A. You can apply and release the brakes in the usual way on the train, but the engine and tender brake will be cut out entirely.

Q. To break the branch pipe from the train pipe to the distributing valve? A. Blank the branch pipe at both ends.

Q. Would this disable the brake? A. The brake may be applied and released with independent brake valve.

Q. To break the brake pipe off at the driver brake cylinder? A. Close the cut-out cock in the branch pipe.

Q. Would this disable the brake? A. You can then use the engine truck and tender truck brake.

Q. To break the application pipe? A. Blank it at the distributing valve connection.

Q. Would this disable the brake? A. The brakes could be manipulated on engine and train. Automatically the independent brake would be cut out.

Q. To break the distributing valve release pipe? A. It would not effect the use of the automatic brake. You could not apply the brake independent; while the equalizing slide valve would be in release position; but with an automatic application of the brakes, while the equalizing portion is on lap, the engine brake may be released independently and reapplied.

Q. Would this effect the holding feature? A. Yes.

Q. How could you regain the holding feature? A. By blanking the release pipe at the distributing valve you have the use of both the independent brake and the holding feature.

Q. How can this be manipulated? A. Apply the brakes automatically; you may release the train brake automatically, but the engine brakes must be released with the independent brake valve. In this case you have the full use of the independent brake.

Q. If the feed pipe should break, what would happen? A. The brake would apply in the emergency.

Q. What would happen to the main reservoir pressure and the pumps? A. The main reservoir pressure would escape to the atmosphere as fast as the feed port in the feed valve would allow it; the pumps would speed up very quickly.

Q. How would you remedy this trouble? A. Slack the tension of the feed valve spring, to allow the regulating valve to seat; this will hold the main reservoir pressure and the pump will quickly build it up again.

Q. Can the brakes be operated with the feed valve pipe

broken? A. Yes; carry the brake valve handle in release position; when wishing to apply the brakes bring the handle to the emergency position and reduce the train pipe pressure very gradually, being careful in returning the handle to lap position.

matic brake valves? A. Yes.

Q. If you fail to blank the brake valve, what will occur? A. The moment the brake valve would be brought to running position the brakes would apply in the emergency.

Q. To break the reducing pipe, what would happen? A. It would cause a heavy main reservoir leak.

Q. How would you remedy this? A. Slack the tension on the reducing valve regulating spring to stop the main reservoir leak; now you have no pressure to seat the independent rotary; block the application pipe at the distributing valve.

Q. What part of the brake would this cut out? A. The independent brake would be cut out entirely.

Q. Would it effect any other part of the air system? A. Yes; the signal system would be cut out.

Q. To break the equalizing pipe, what would happen? A. The brakes would apply in full service.

Q. How would you remedy this? A. Blank at "T" at brake valve, also blank the train pipe exhaust; run with brake valve handle in release position.

Q. How would you make a service application of the brakes? A. The same as explained in broken feed valve pipe.

Q. When a service application of the brakes require the brake valve handle to be moved to emergency position, how can you tell what train pipe reduction is being made? A. The black pointer on the small gauge will indicate the reduction in the train pipe pressure and the red pointer will indicate the brake cylinder pressure.

Q. In returning the brake valve handle quickly from run-

ning position, what is likely to occur? A. It has a tendency to kick the front brakes off.

Q. In double-heading, to break the circulation pipe on the head engine? A. Blank both ends of the broken pipe and go ahead.

Q. To break circulation pipe on second engine? A. Blank at both ends of broken pipe, turn cut-out cock one-half way between open and shut, carry brake valve handle in running position and go ahead. (If using Westinghouse cut-out cock you have no circulating pipe.)

Q. If train pipe exhaust pipe breaks on lead engine? A. Go ahead; you don't need it.

Q. If it breaks on second engine? A. Blank the train pipe exhaust.

NOTE—With the Westinghouse cut-out cock you have no exhaust pipe.

Q. If pipe to maximum governor head breaks? A. Blank pipe at main reservoir pipe; the excess governor head will stop the pump if the automatic brake valve handle is carried in release, running or holding position.

Q. To break the lower pipe off of the excess governor head, what will happen? A. It will cause a main reservoir leak in the three first positions of the automatic brake valve. Pound the end of the pipe shut and go ahead.

Q. To break the top off the excess governor head, how could we remedy it? A. Blank both pipes to excess governor head.

TESTING THE BRAKE.

Q. On taking the engine from the roundhouse we must know that the brakes are in proper working order; hence we test and see A. Properly charge the system, see that all cut-out cocks are open, except the ones on the front and rear end of train pipe and the one in the by-pass pipe.

Q. Test for brake cylinder leakage? A. Make a light application of the brake; lap the brake valve; close the cut-out cock in the supply pipe; the red hand on the small

gauge will indicate the brake cylinder pressure.

Q. If the brakes leak off when applied with either the automatic or independent brake valve, wher is the trouble? A. There is either a leak in the application pipe, release pipe application cylinder cap, or the safety valve.

Q. Test the distributing valve? A. Charge the system; make a five-pound reduction; if the brakes do not apply there is undue friction in the operative parts of the distributing valve. Charge up and make a 10-pound reduction. This should give a brake cylinder pressure of 25 lbs. with brake valve on lap.

NOTE—If the brake cylinder pressure gradually increases, if it does, there is a leak in the application cylinder. If the brake cylinder pressure raises to 45 lbs. and stops there the independent rotary valve is leaking; but if the cylinder pressure raises to 50 lbs. the equalizing slide valve is leaking.

SAFETY VALVE.

Q. Test the safety valve? A. Charge the system; apply the brakes and note what pressure the safety valve lifts and seats; it should be 68 lbs and not allowed to go above 70 lbs. Release, place the independent brake valve in quick-action service position.

NOTE—The brake cylinder pressure should build up 45 lbs. in from two to three seconds. Release, place independent brake valve handle in slow service position, then if the brake cylinder pressure builds up to 40 lbs. in five to six seconds you may count the distributing valve O K.

FEED VALVE TEST.

Q. Test the feed valve. A. 1—Charge the system to the standard pressure; then cause a train pipe leak of 7 to 10 lbs. per minute by slightly opening the angle cock; then watch the fluctuation of the train pipe pointer on the small

gauge. The fluctuation of this pointer will indicate the opening and closing points of the feed valve and should not vary more than two lbs.

2—If the train pipe pointer does not move it indicates too loose a supply valve piston and the leak is being supplied past the piston and regulating valve.

3—If the fluctuation is more than two lbs. the feed valve is dirty and needs to be cleaned.

GOVERNOR TEST.

Q. Test the pump governor. A. The standard main reservoir pressure on some roads is 90 lbs. and on others 100 lbs., which means with a 70-lb. train pipe pressure and a 90-lb. main reservoir pressure you have an access pressure of 20 lbs.; while where a 100-lb. main reservoir pressure is the standard you have 30 lbs. excess pressure. In either case the main reservoir pointer should indicate the standard pressure and the train pipe pointer should show the standard pressure with brake valve handle in either running or holding position. Lap the brake valve and the main reservoir pointer should raise to the tension of the maximum governor top. With the feed valve adjusted to the standard pressure the regulating spring in the excess governor head must be adjusted to the difference between the main reservoir and the train pipe pressure, which would be 30 lbs., with a 100-lb. main reservoir pressure.

TRAIN PIPE TEST.

Q. Test the train pipe? A. Make a 5-lb reduction; lap the brake valve and note the train pipe leakage, which will be indicated by the black hand on the small gauge. The leakage should not exceed five lbs. per minute.

AUTOMATIC BRAKE VALVE TEST.

Q. Test the automatic brake valve? A. Place the brake valve in service position and allow it to remain there until the equalizing reservoir and the train pipe pressures have been exhausted. Close the cut-out cock under the brake valve (if using the straight Westinghouse brake). Lap

the brake valve and note if there is a blow at the train pipe exhaust. If so the rotary valve or the body gasket (the lower gasket No. 19) is leaking main reservoir air into the train pipe. While the brake valve is on lap note if the black hand on the large gauge raises from zero; the top gasket No. 18 is leaking main reservoir air into Chamber "D" and the equalizing reservoir.

Q. If with the brake valve in either release, running or holding position, there is a constant blow at the train pipe exhaust, what is the trouble? A. The equalizing discharge valve is unseated.

Q. How can this be remedied? A. By placing the brake valve in service position and tap on the side of the body of the valve.

Q. If this will not dislodge the obstruction, what next would you do? A. Take out the train pipe exhaust plug and stir in with a pointed piece of wood.

INDEPENDENT BRAKE VALVE.

Q. To test independent brake valve? A. Make a light application of the brake, then if the brake cylinder pressure raises to 45 lbs. the rotary valve is leaking.

Q. Test the reducing valve? A. Make a full independent application of the brake; if the reducing valve is properly adjusted the red hand on the small gauge will register 45 lbs.

MISCELLANEOUS QUESTIONS.

Q. With the P. R. R. cut-out cock inserted in the main reservoir pipe, how would you arrange to test the automatic brake valve? A. If using a triple valve on tender close cut-out cock in branch pipe to triple. Place automatic brake valve in service position until equalizing reservoir and train pipe pressure are exhausted, then place the independent brake valve in release position and hold it there until the blow stops; then place the automatic brake valve on lap and wait for the pressure to raise. This will take a little longer than with the Westinghouse cut-out

cock in the train pipe.

Q. If, while descending a grade, you make a service application of the brake, and while holding the brake applied you notice the main reservoir pressure has dropped below the train pipe pressure and your pumps are traveling at high speed, what is the trouble? A. Leaky brake cylinders.

Q. What would you do? A. The train brakes could not be released. Bring the train to a stop. Release the engine brakes with the independent brake valve. When the main reservoir pressure is pumped up release the train brakes. When the auxiliaries are recharged go ahead.

Q. How would you overcome this trouble the next time you applied the brake? A. Apply the brakes in the usual way. When the train pipe exhaust ceases release the engine brakes with the independent brake valve; this will allow the main reservoir pressure to build up.

Q. If the main reservoir pressure is either above or below the standard, where is the trouble? A. The regulating spring in the excess or low pressure governor head is not properly adjusted.

Q. How would you adjust this spring? A. First you must know that the feed valve is properly adjusted. Place the automatic brake valve handle in running position and slack or tighten the regulating nut.

Q. How should the brake valve handle work? A. Easy.

Q. If the handle of either brake valve is hard to work, how could you remedy this? A. Close the main reservoir cut-out cock under the automatic brake and blow all the pressure out; remove the cap nut from the rotary stem and oil through the oil hole, bearing down on the handle to work the oil down, also remove the oil plug from the body of the valve and oil the rotary valve. Move the handle from one extreme position to the other.

Q. Why is a gauge used to indicate both equalizing and train pipe pressures? A. Because with the G-6 brake valve

the packing ring on the equalizing piston does not fit perfectly tight in the bush, and with the brake valve on lap train pipe leakage will reduce the Chamber "D" pressure; but with the H-6 brake valve the equalizing piston packing rings form an air-tight joint and no equalizing can occur. To test this lap the brake valve, open the angle cock and note the train pipe pointer dropping to zero, but the equalizing pointer will not move.

Q. Does long or short piston travel effect the brake? A. No.

Q. Why? A. Because the brake cylinder pressure must equal that of the application cylinder before the main reservoir pressure is cut off.

Q. Will leaky brake cylinders leak the brake off? A. No.

Q. Why? A. Because when the brake cylinder pressure reduces below the application cylinder pressure the application piston is moved to application position and the brake cylinder pressure quickly built up again.

Q. If you have an idea that the brake cylinder gauge is not correct, how would you test it? A. If you know that the reducing valve is properly adjusted make a full independent application of the brake, and the brake cylinder pointer should register at 45 lbs. Another way is to make a light service application with the automatic brake valve, noting the exact number of pounds reduced, multiply this by 2½, the answer will be the number of pounds the brake cylinder pointer should point to.

Q. Explain how the air passes through the apparatus in an emergency application of the brake. A. The automatic brake valve being placed in the emergency position, air passes direct from the train pipe to the atmosphere. The train pipe pressure being suddenly reduced brings the equalizing portion of the distributing valve to emergency position, which opens communication between pressure chamber and application chamber and cylinder and air passes to the face of application piston; moves application

portion to application position; air also passes from the top of automatic rotary to the application cylinder, which builds the application cylinder pressure very high, which holds the application portion to application position, which permits main reservoir pressure to flow into the brake cylinder constant. The high application cylinder pressure lifts the safety valve and air from the application chamber flows to the atmosphere through the retarded port in the equalizing slide valve and safety valve; the two pressures combined hold the application portion, and the main reservoir pressure equalizes in the brake cylinder almost 96 lbs. per square inch, this pressure being reduced by blowing down the application chamber pressure through the retarded port and safety valve, which requires from 18 to 26 seconds to reduce from 96 to 68 lbs., the normal brake cylinder pressure.

Q. Can the brake be used on a dead engine, say, placed back of 20 cars in a train? A. Yes; the brakes can be applied and released on the dead engine.

Q. Explain the dead engine feature and show where the air comes from to apply the brakes on a dead engine. A. Close the cut-out cock in the train pipe under the brake valve. If using P. R. R. cut-out cock then blank the train pipe under the brake valve and open the cut-out cock in the by-pass pipe; then train pipe air will pass through the by-pass pipe into the main reservoir. The non-return check valve is held to its seat by a spring with a 20-lb. tention. Hence from a 70-lb. train pipe pressure we get 50 lbs. pressure in the main reservoir and through the supply pipe to the distributing.

Q. What brake cylinder pressure will we get from a 15-lb. train pipe reduction? A. 37½ lbs. per square inch.

Q. Would you slack the reducing or feed valve? A. No.

Q. What must be done with both brake valves? A. Both brake valves must be placed in running position and fastened so they cannot move.

Q. Could the brakes be applied with either brake valve handle in any other position? A. Yes.

Q. Could the brakes be released? A. No.

Q. What would occur if the maximum governor head was out of service and the automatic brake valve handle was left on the lap? A. The main reservoir pressure would run very high.

Q. If with both brake valves in running position a blow occurs at the straight exhaust of the automatic brake valve, where is the trouble? A. Air is leaking past the independent rotary valve, equalizing slide valve or the distributing valve gasket.

Q. How can you tell which of these parts are causing the blow? A. Unconnect the release pipe; lap the automatic brake valve; then if the air blows down the independent rotary is leaking. If the air blows up the equalizing slide valve or the distributing valve gasket is leaking; but you cannot tell which of the latter is causing the blow without taking the distributing valve apart.

Q. You think that the system is charged up; you make an automatic application of the brakes, but the engine brakes do not apply. Where is the trouble? A The strainer at the junction of the train pipe and branch to the distributing valve is clogged up, or the feed groove in the equalizing piston bush is clogged up.

Q. Can the engine brakes be applied if the pressure chamber is not charged? A. Yes; independently, but not automatically.

Q. With an automatic application of the brakes, may the engine brake be released while holding them on the train? A. Yes; the engine brakes may be partially or wholly released and lightly or fully applied again with the independent brake valve.

Q. Can the brakes be released on the train and held on the engine? A. Yes, with the automatic brake valve.

Q. Do leaky brake cylinders cause brakes to release?

A. No.

Q What will cause brakes to release? A. A leak in the application pipe; release pipe or the application cylinder cap or safety valve.

Q. If the top pipe of the excess governor head breaks and you fail to blank the lower pipe, what will occur? A. The pump will stop and you cannot get it to work.

Q. Then what must be done? A. Blank the lower pipe.

Q. Why will the pump stop when the top pipe to the excess governor head is broken? A. Because when the top pipe is broken it takes the pressure off the diaphragm, the main reservoir air raises the pin valve, forces the piston down, seating the steam valve.

Q. Have you ever noticed that with the automatic brake valve handle in either running or holding position, to cut in uncharged cars the pump will stop for a while? What causes the pump to stop? A. When uncharged cars are cut in it reduces the train pipe pressure. With the brake valve handle in either running or holding position the port in the rotary valve which leads from the feed valve pipe to the train pipe is much larger than the feed port in the feed valve, hence the feed pipe pressure is greatly reduced; this lightens the pressure above the diaphragm of the excess governor head, thus the pin valve will be unseated and the pump will stop.

Q. How long will the pump remain standing still? A. Until the train pipe and feed valve pipe pressures are raised to within 30 lbs. of the main reservoir pressure.

Q. Would you release the brakes on a long freight train while in motion the same as with a long passenger train? A. No; the automatic brake valve handle should be moved to release position and left there for a time, according to the length of the train, the time should not exceed 20 seconds.

Q. Why do this? A. To insure a proper release of all the brakes.

Q. After making a release on a long train and the brake valve handle has been brought to a running position, should it be returned to release position again? A. Yes, but not until it has remained in running position from three to five seconds, then return to release position from one to two seconds, then to running position.

Q. Why should this be done? A. In releasing the brakes some of the auxiliaries on the front end may be overcharged; if so those brakes may be reapplying and cause them to drag; by moving the brake valve handle to release position for an instant will release such brakes.

Q We say the feed grooves in the K-1 and K-2 triple valves are of the same size. Why does the K-2 triple charge a large reservoir in the same time that a K-1 triple takes to charge a small reservoir? A. The K-2 triple having the larger reservoir to charge is supplied with an extra feed port leading from cavity "Y" through the body of the triple and slide valve to the auxiliary; thus charging two ways through the K-2 triple, while the K-1 triple charges but one way.

Q. With the brakes released there is a constant blow at the distributing valve exhaust, where is the trouble? A. The application valve is leaking.

Q. With the brakes applied there is a blow at the distributing valve exhaust, what is causing it? A. The exhaust valve is leaking

Q. If while running along with a passenger train the crew notice a brake sticking, how can the conductor communicate with the engineer to get him to release the brakes? A. By giving him one blast of the signal whistle then the engineer will precede to release the brakes.

Q. How would he do this? A. If the train pipe pressure is up to the standard, he should make an 8 to 10 lbs. service application and make a proper release. If the brakes cannot be released in this way he must stop and ascertain the trouble.

Q. With the E. T. equipment where do the pipes branching off from the main reservoir lead to? A. To the distributing valve, feed valve, automatic brake valve and reducing valve.

Q. With the E. T. equipment where do the pipes lead to that branch from the main reservoir pipe? A. To the automatic brake valve, to the distributing valve, to the feed valve, to the reducing valve, to the pump governor and to the red pointer on the large gauge.

MANIPULATION.

NOTICE—Carefully the handling of the E. T. brake.

Q. On coupling to a train, in which position would you place the automatic brake valve handle while charging the brake system? A. In release position.

Q. How long would you leave the handle in this position? A. Until the system charges up to the standard pressure carried.

Q. Then to what position would you move it? A. To running position.

Q. What train pipe reduction would you make to make a terminal test of the brakes? A. 25 lbs.

Q. What do you understand by an application? A. An application means, from the time the brakes are applied until they are released, regardless of the number of train pipe reductions that are used to apply them.

Q. When starting to apply the brakes would you first place the brake valve handle in release position for a second or two? A. No; that is the habit of some men, but should not be done, this overcharges the train pipe and causes a much greater volume of air to pass through the train pipe exhaust before the train pipe pressure is reduced 5 lbs. below auxiliary equalization and will result in not getting the pistons out at all from a light reduction.

Q. How would you make a two application passenger

stop with a short train of nine cars or less? A. When the speed of the train has been reduced to about 12 miles per hour by the first application, release the brakes preparatory to the second application, by moving the brake valve handle from lap to running position, leave it there for about 2 seconds or until the brakes start to release, then bring it back to lap position again and leave it there until you want to make the second application, after making the second application and just before the train comes to a stop, release the brakes by placing the brake valve handle in running position and let it there.

Q. How would you make a two application stop with a train of more than nine cars? A. With the first application bring the speed down to 15 or 18 miles per hour, then release by placing the brake valve handle in release position for about three seconds, then to lap position and leave it there. The second application of the brakes should be held applied until the train stops, then release by placing the brake valve handle in release position until the train line pointer registers the standard pressure, then bring handle to running position and leave it there.

Q. How would you make a two application stop with a freight train? A. The same as with a long passenger train, except on releasing the first application, leave the brake valve in release position longer according to the length of the train, and never release either application at low speed.

Q. While handling trains with the automatic brake valve. In which position must the independent brake valve be? A. In running position always.

Q. In handling a light engine which brakes should be used? A. The independent brake valve.

Q. If with the feed valve pipe broken you carry the automatic brake valve in release position, then you apply the brakes by going to the emergency position, would you still have the holding feature? A. Yes.

Q. How would you release these brakes? A. By placing the automatic brake valve in release position to release position to release the train brakes; then to running position to release the engine brakes; then back to the release position to recharge the train and leave it there. Another way by which the brakes may be released. Place the automatic brake valve handle in release position and let it there, afterwards release the engine brakes with the independent brake valve by moving it to release position and hold it there until the engine brakes are fully released.

Q. May an examination of the operative parts be made without disturbing the pipes? A. Yes, the distributing valve is so arranged that the operative parts may be removed without disturbing any of the pipes or their joints or unions.

SIZE OF PIPES.

Q. What size is the seam pipe to a 9½ inch pump? A. One inch pipe.

Q. What is the size of the exhaust pipe? A. 1¼-inch pipe.

Q. What size are train pipes? A. For engines, tenders and passenger cars, a 1 inch pipe should be used. For freight cars a 1¼ inch pipe.

Q. The pipe from the main reservoir to the brake valve is what size? A. One inch pipe.

Q. What size is the discharge pipe? A. 1¼ inch.

Q. What size is a signal pipe? A. 3-4 inch under engine tender and cars.

Q. The pipe leading from the main reservoir, the signal pipe by way of reducing valve is what size? A. 3-8 inch.

Q. The pipe leading to the car discharge valve is what size? A. ½-inch pipe.

Q. What size pipe leads to the signal whistle from the signal valve? A. This depends on the distance the whis-

tle is located from the valve. If less than 4 feet, a ¼ inch pipe. If more than 4 feet, a 1-8 inch pipe.

Q. What size pipe is from the signal pipe to the signal valve? A. 3-4 inch, reduced at signal valve to ½ inch.

Q. Which is preferrable, an elbow or a bend? A. A long bend, avoid short bends.

Q. How should pipe work be tested? A. By air—using soap suds on outside to locate leaks.

BRAKING POWER PERCENTAGE .

Q. Give the braking power percentage.

Engine drivers and engine truck.....75%
Pasenger cars 90%
Tenders 100%
Freight cars 70%
Compound locomotives 40%

Q. At the end, I can only say to my fellow workmen—and what? A. Remember the first principle in railroading, and take the safe course and run no risk.

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